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(54) Apparatus and method of positioning photosensitive media on an exposure platen

(57) An apparatus includes a media handler which is capable of processing a supply of media sheets which can take the form of plates, aluminum or plastic used in lithographic printing presses or the like, or can be film which is advanced to a drum 18 and scanned by a lazer source 24 and thereafter removed from the drum surface. Each media sheet is gripped by suction devices and moved in turn to the drum 18 by first 32 and second (34 Figure 6) carriages, the carriages closing together as they approach the drum so that the sheet adopts the required curved configuration. After exposure each sheet is discharged at means 152.

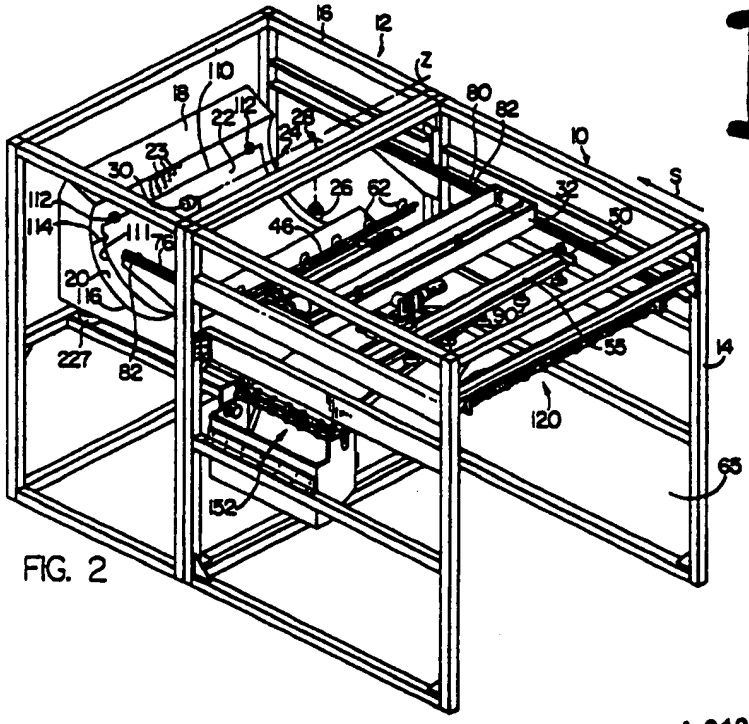

FIG. 2

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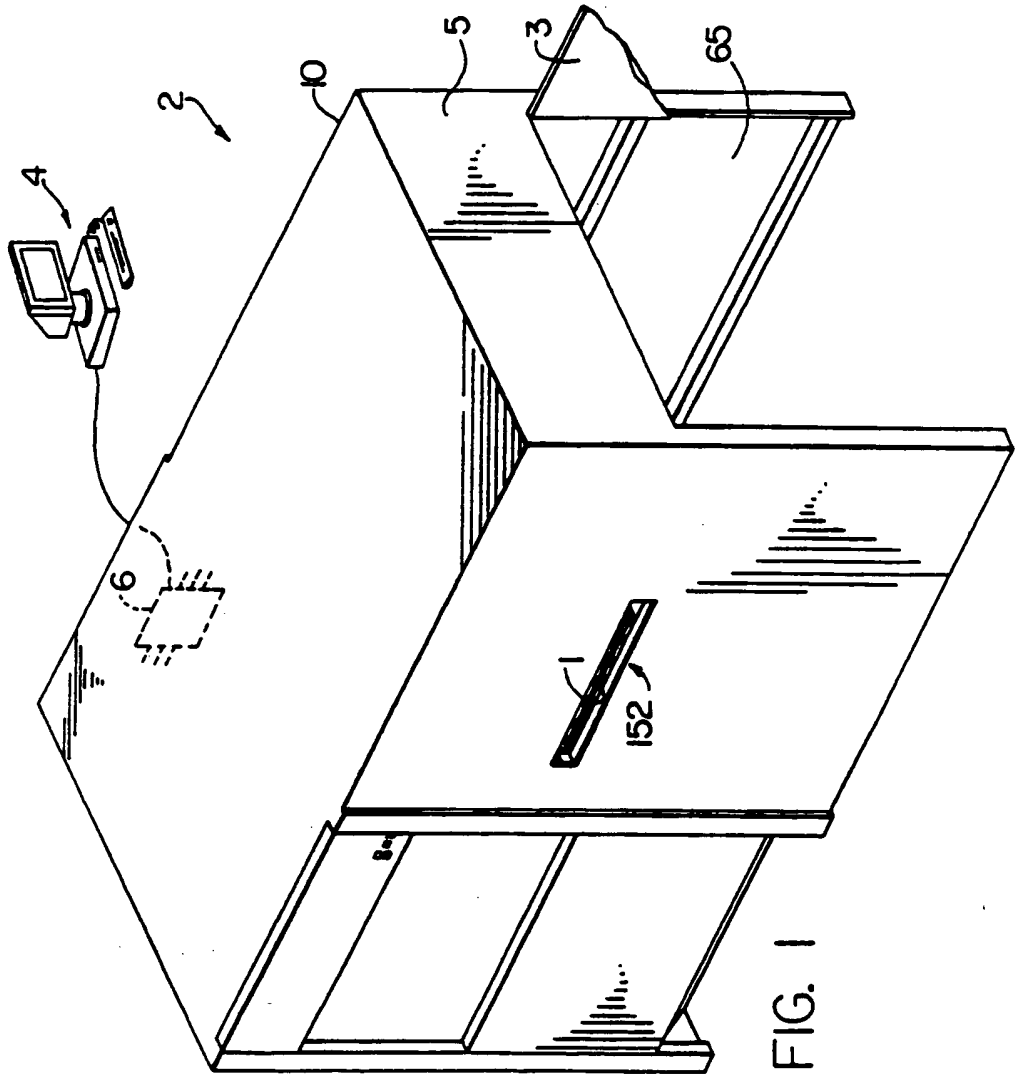
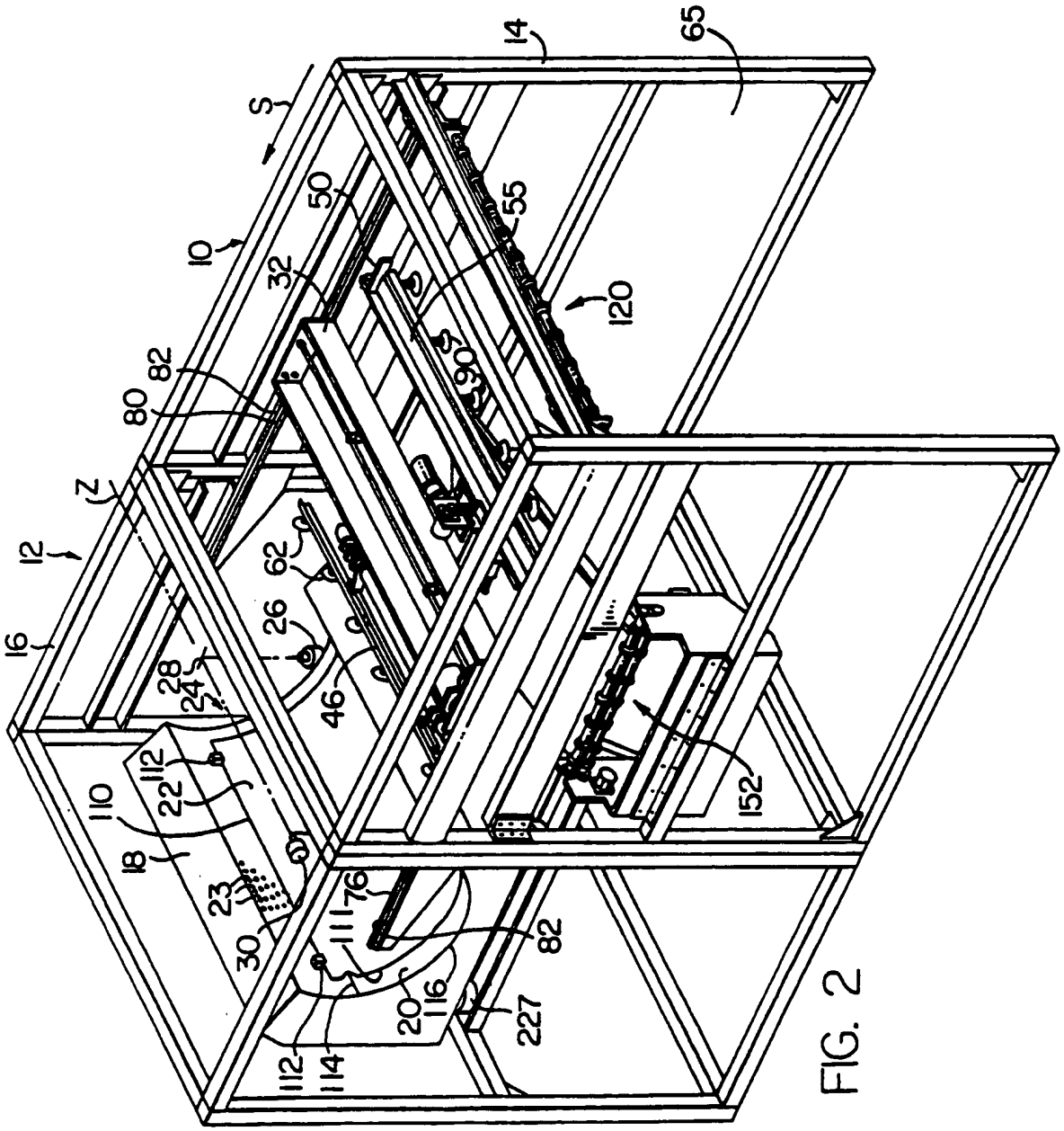


FIG. 1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65
S
50
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10
32
120
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26
16
28
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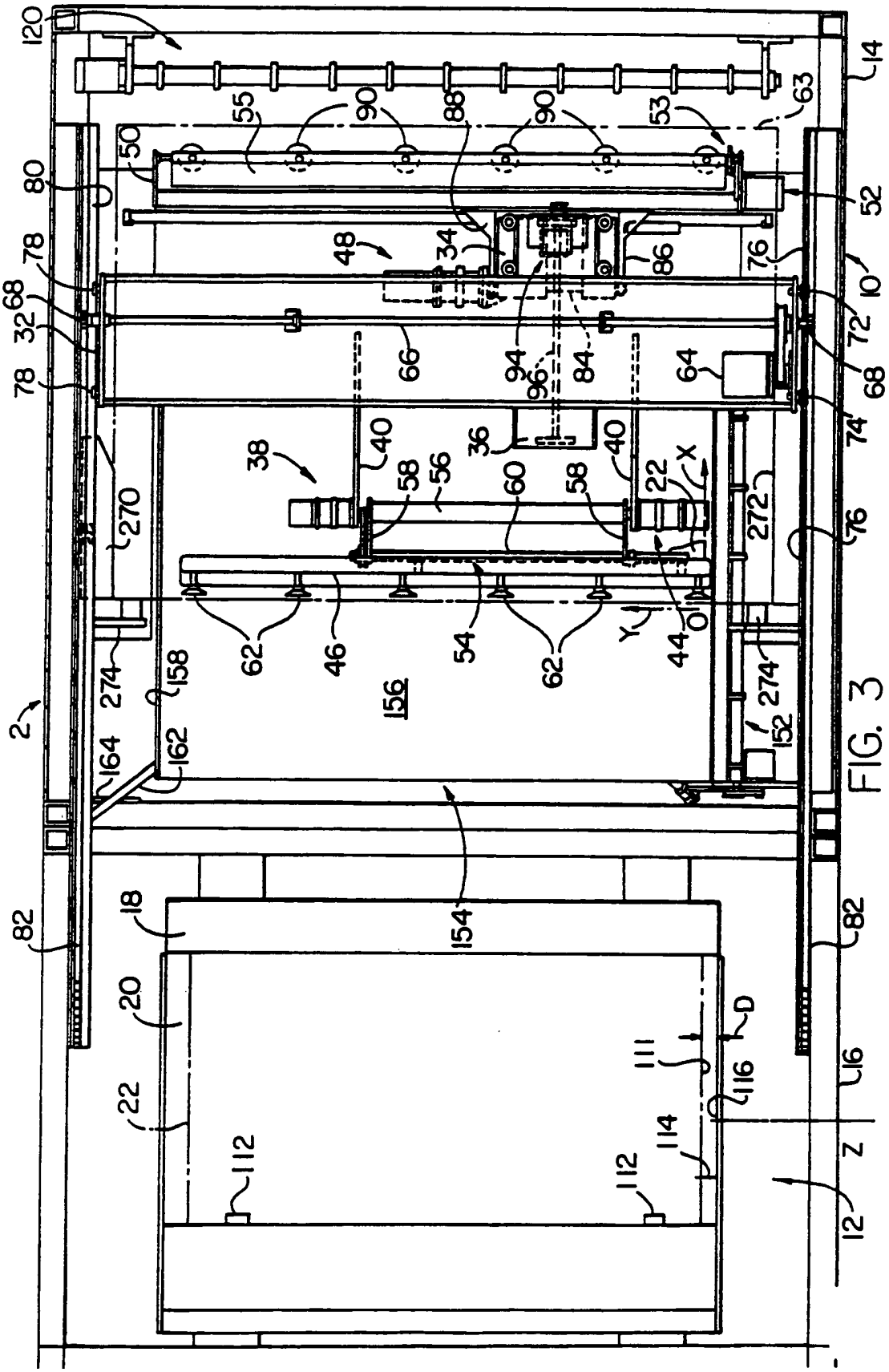
114

FIG. 2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68
74
38
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40
58
56
60
58
22
X
270
272
76
62
46
54
62
Y
44
O
156
274
158
274
152
2
164
162
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18
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D
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112
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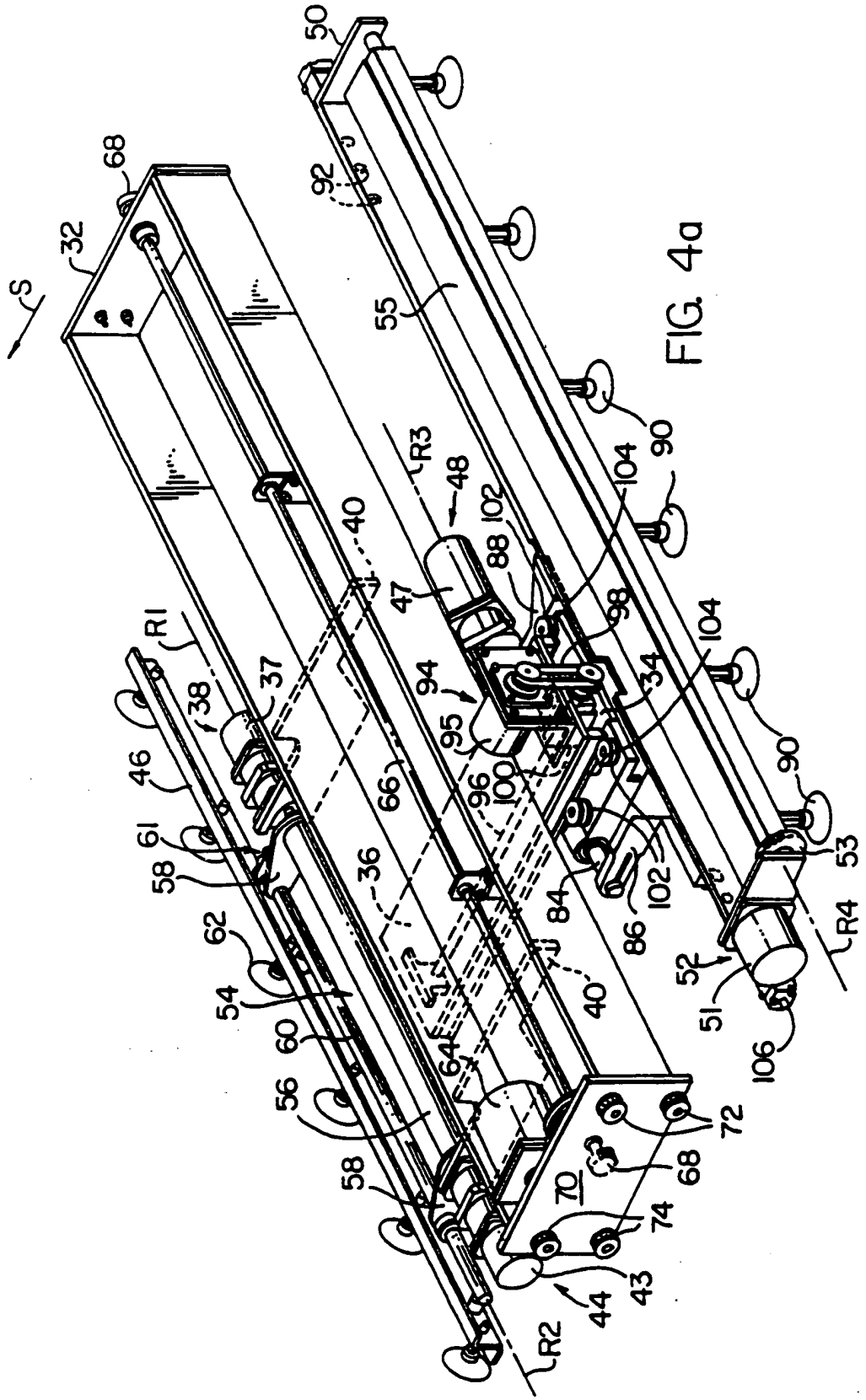
Z
12

FIG. 3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R3
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102
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36
84
86
52
51
106
53
R4
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44
R2

FIG. 4a

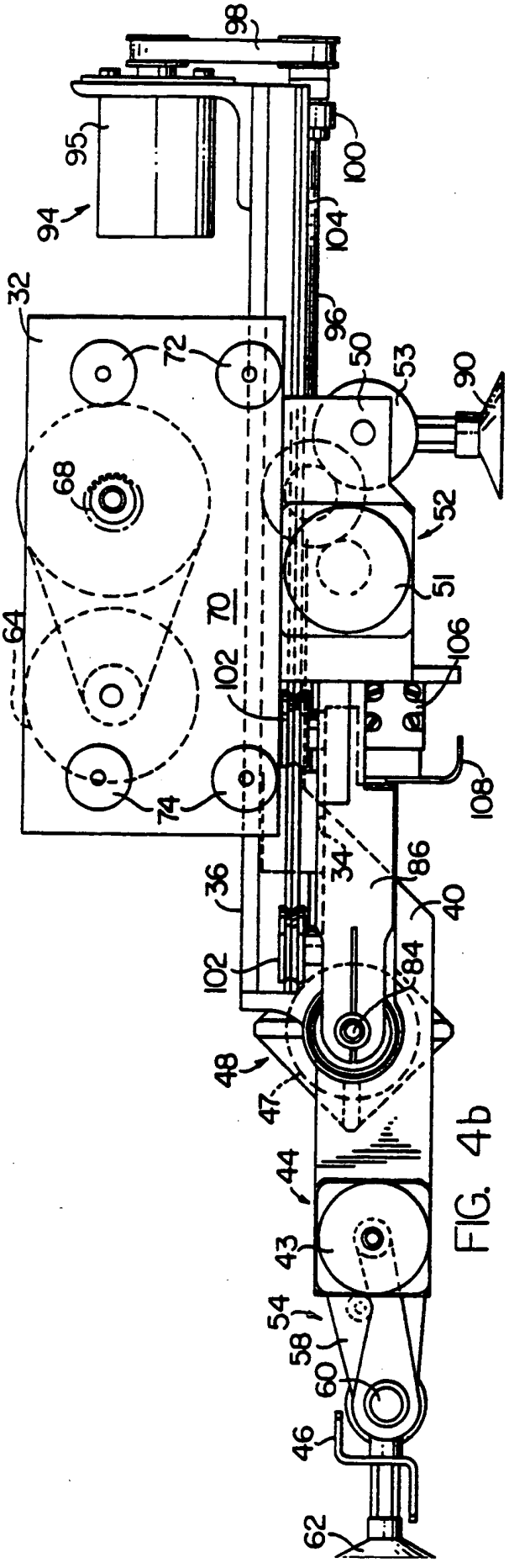
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FIG. 4b

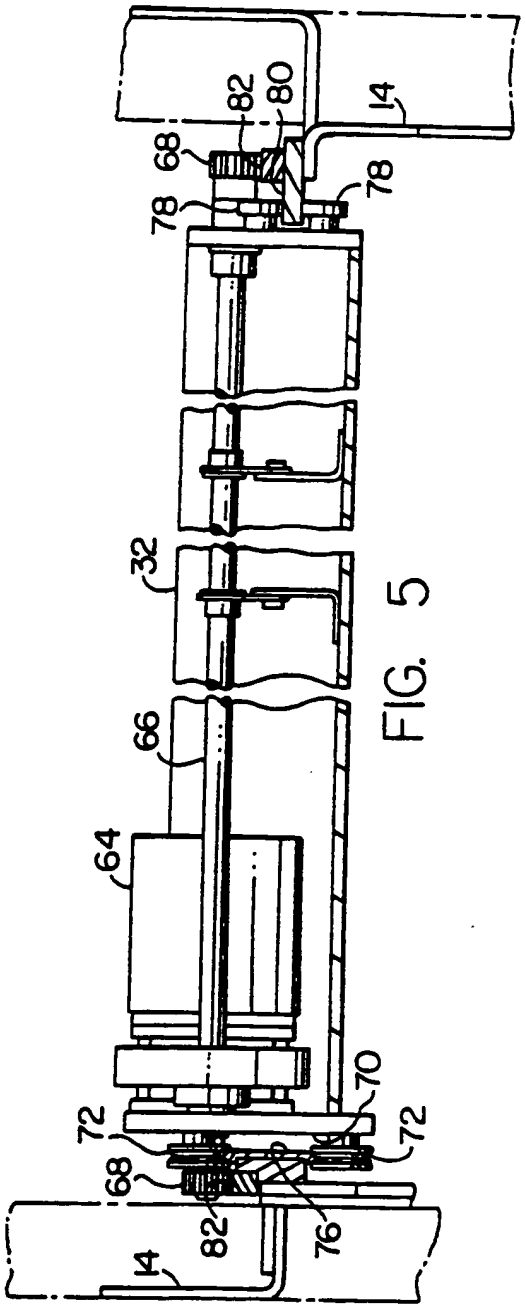

FIG. 5

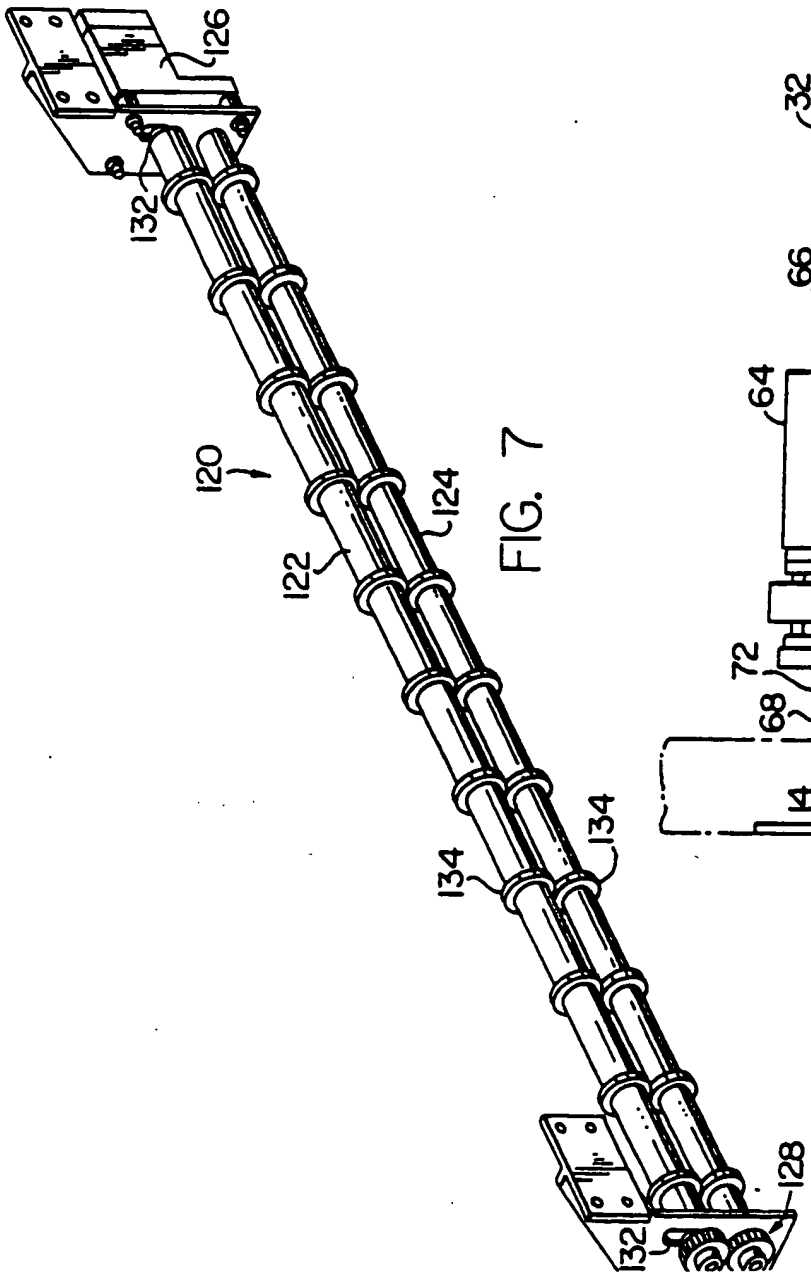

FIG. 7

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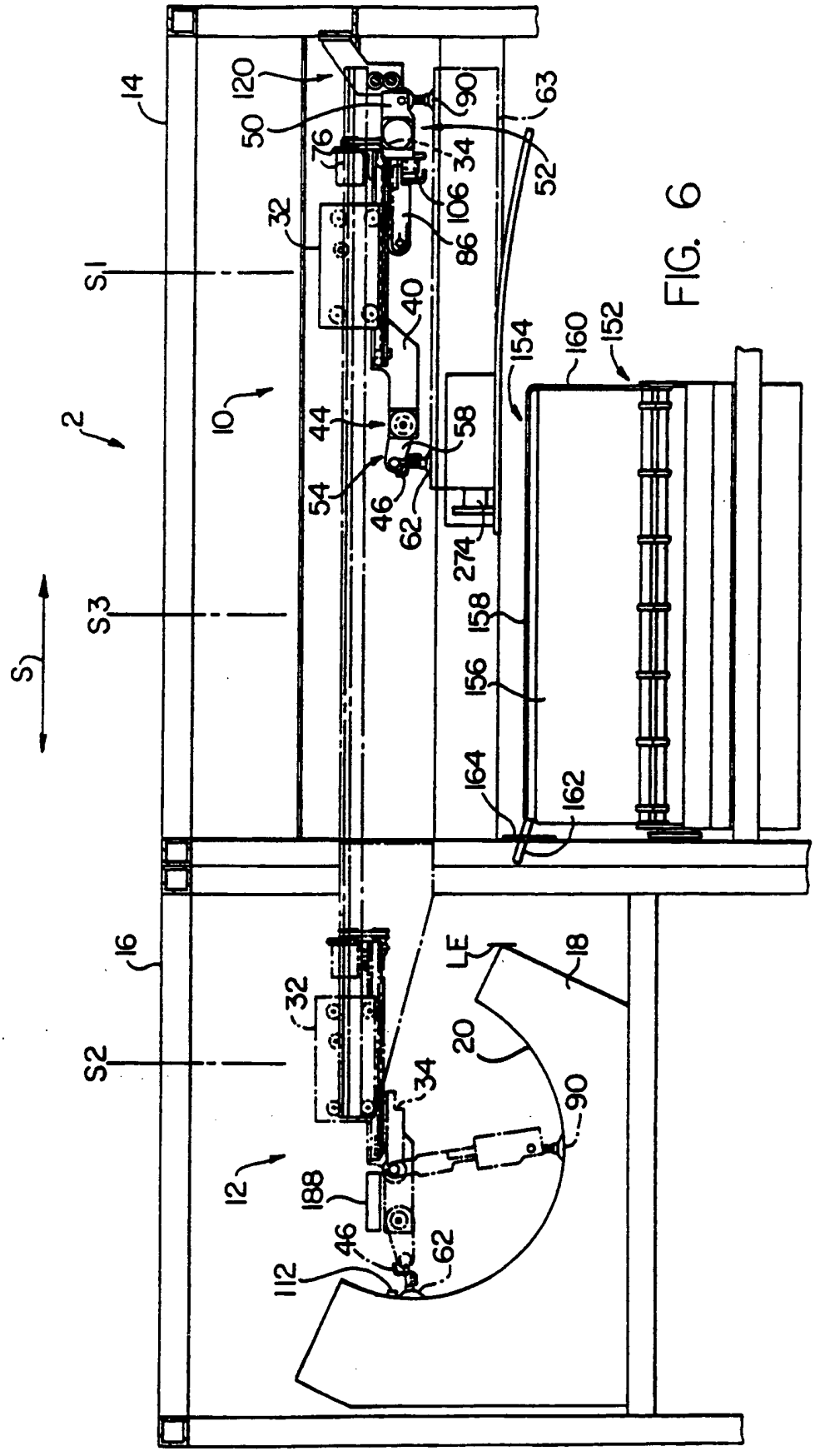
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274
S3
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S2
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112

FIG. 6

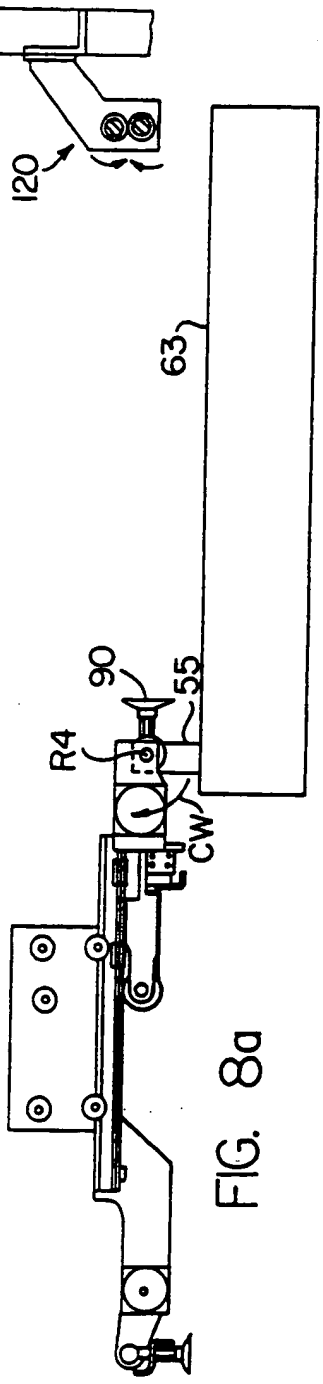

FIG. 8a

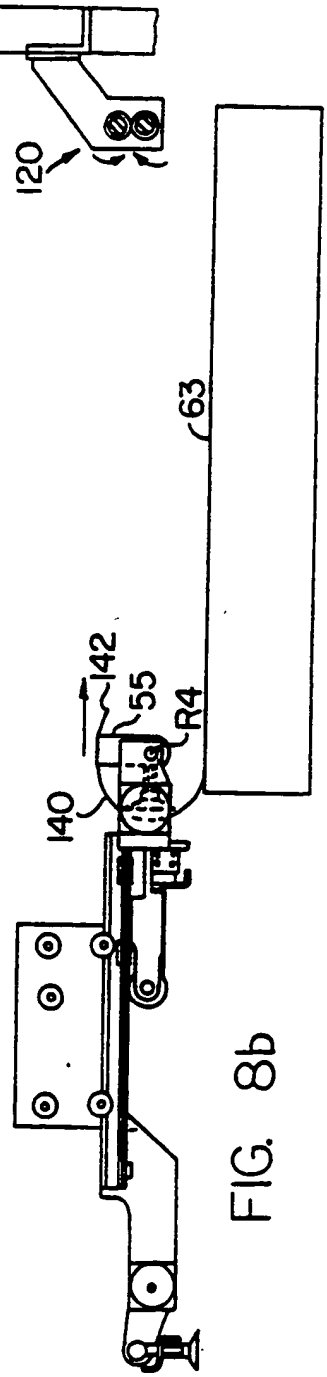

FIG. 8b

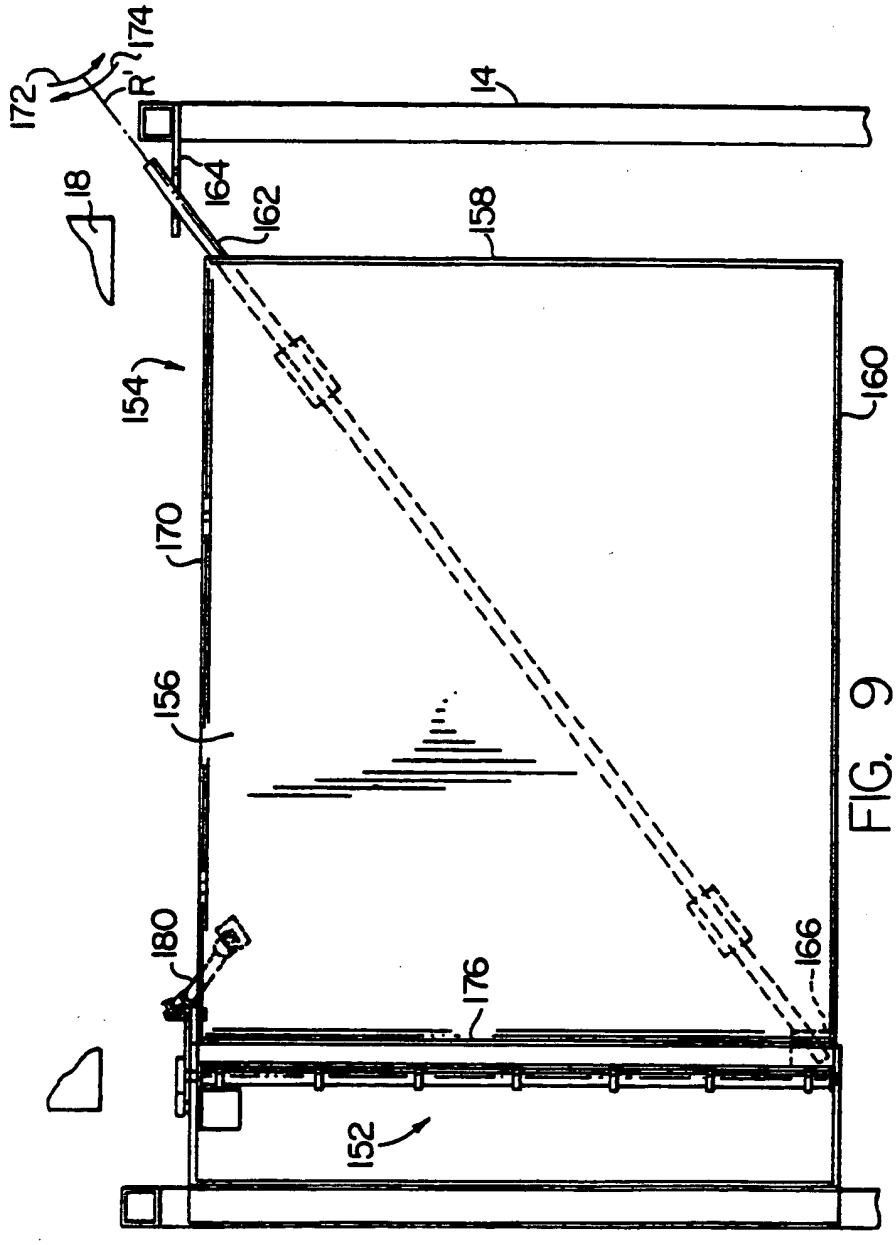

FIG. 9

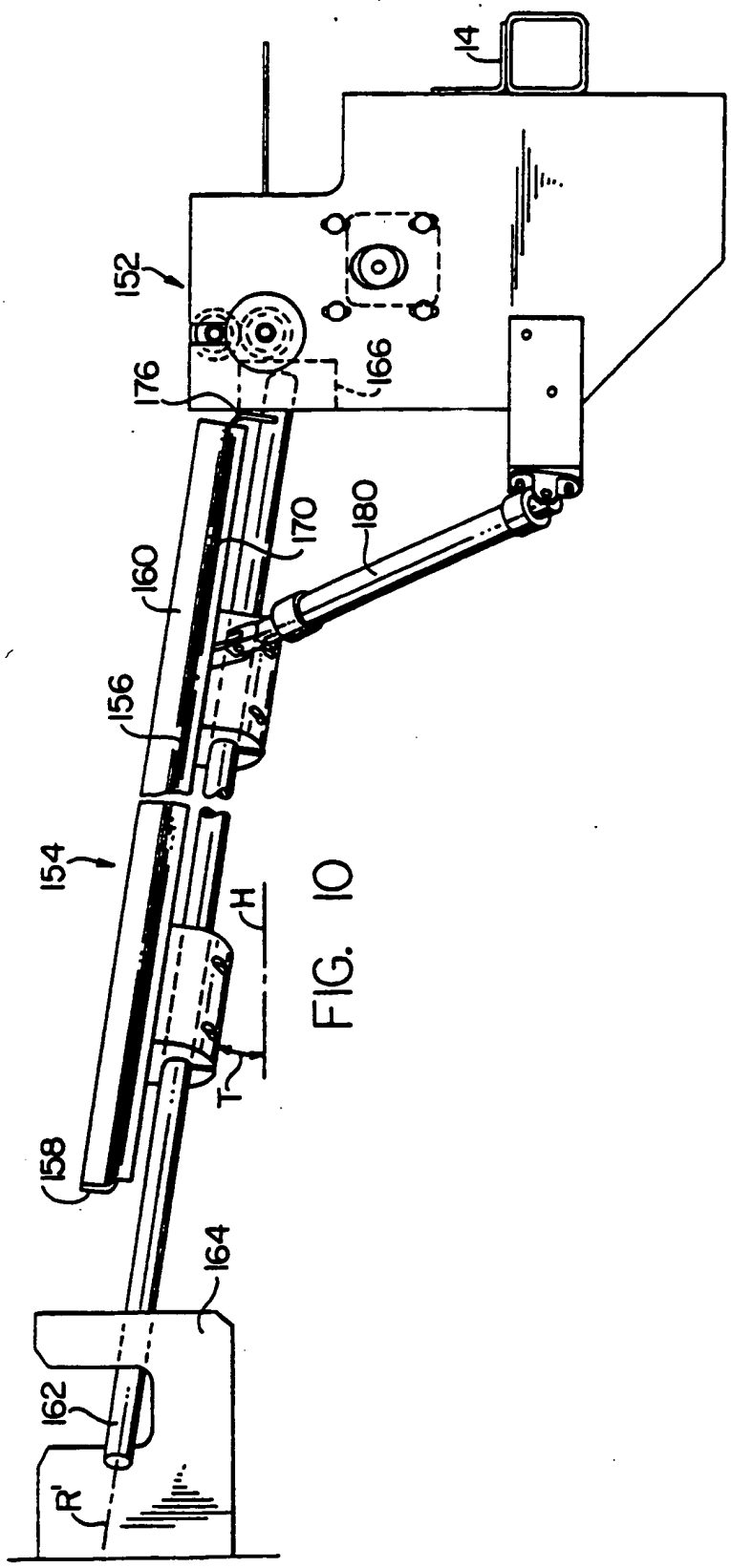

FIG. 10

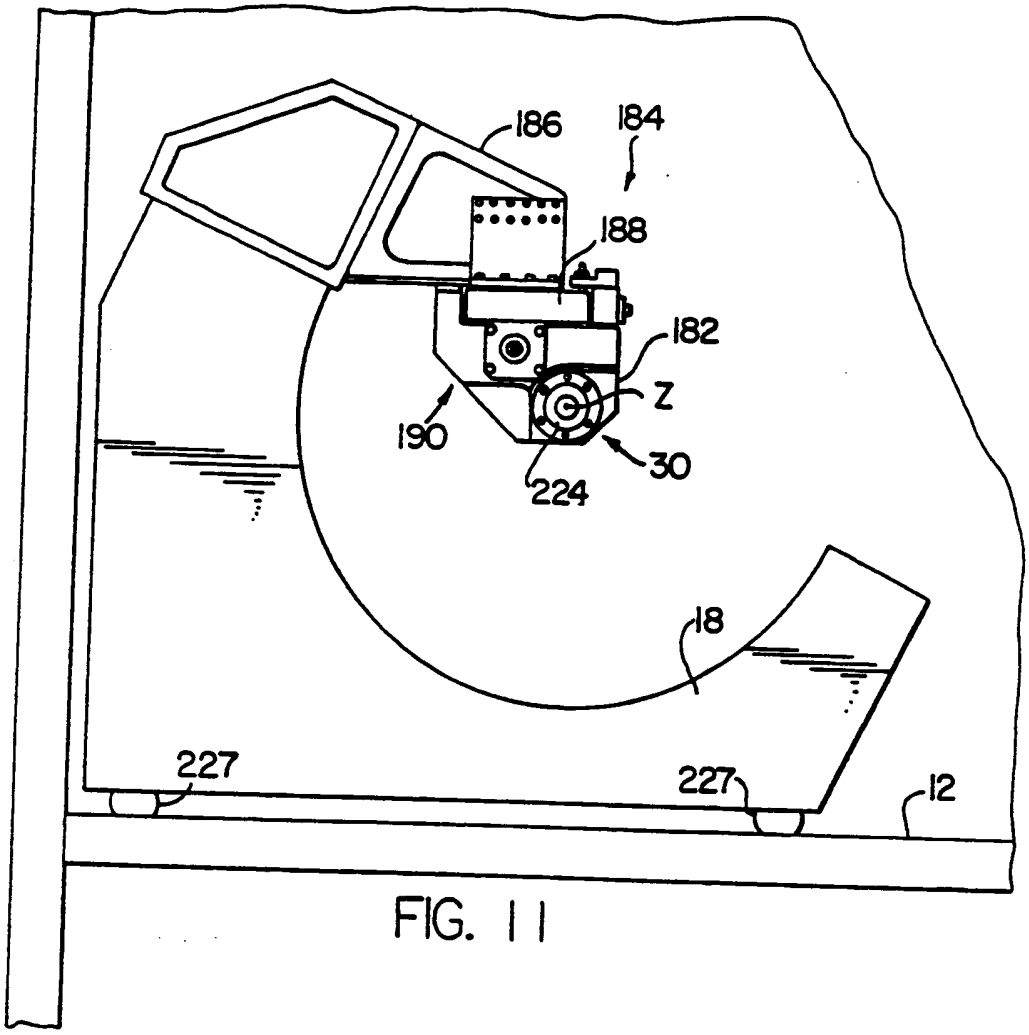

FIG. 11

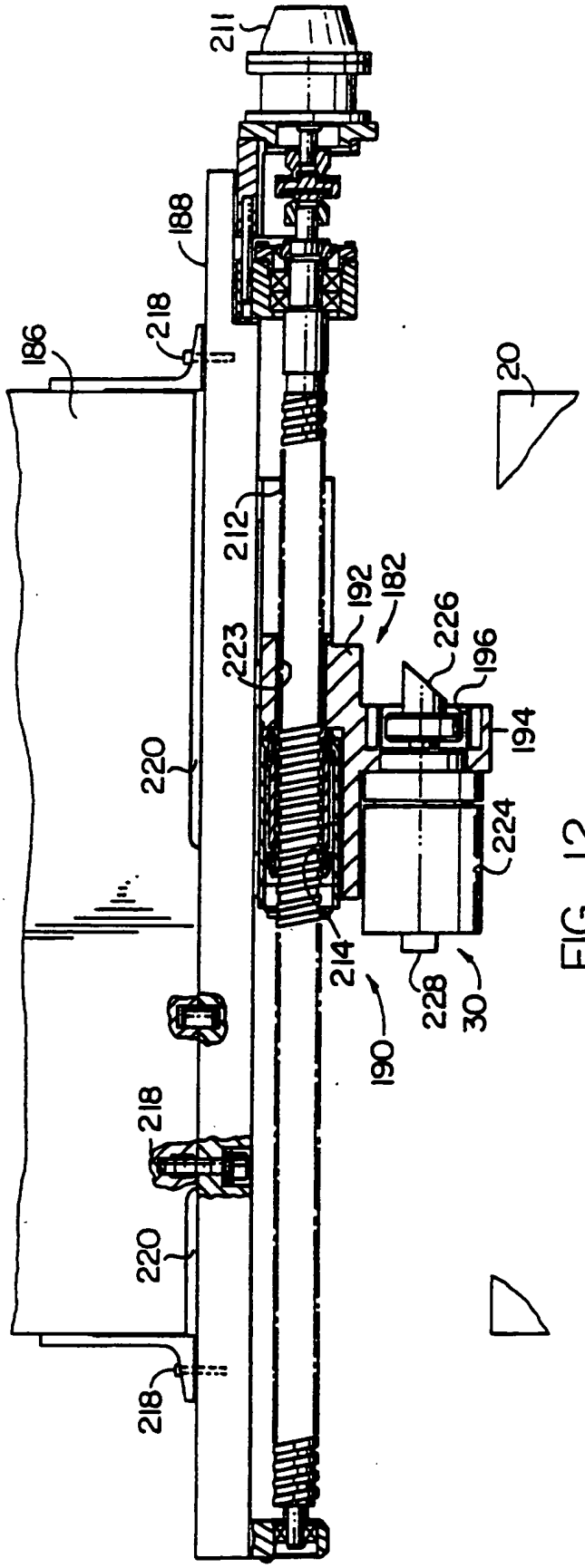
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FIG. 12

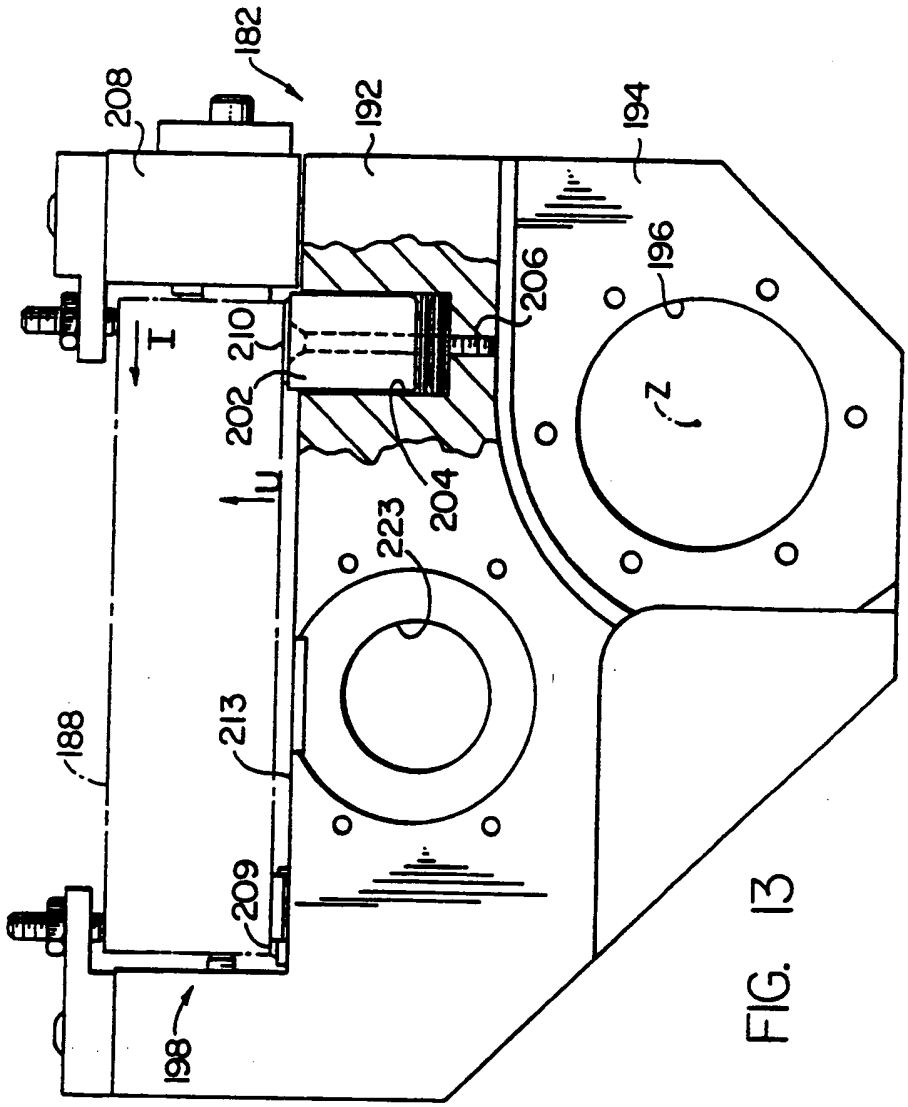

FIG. 13

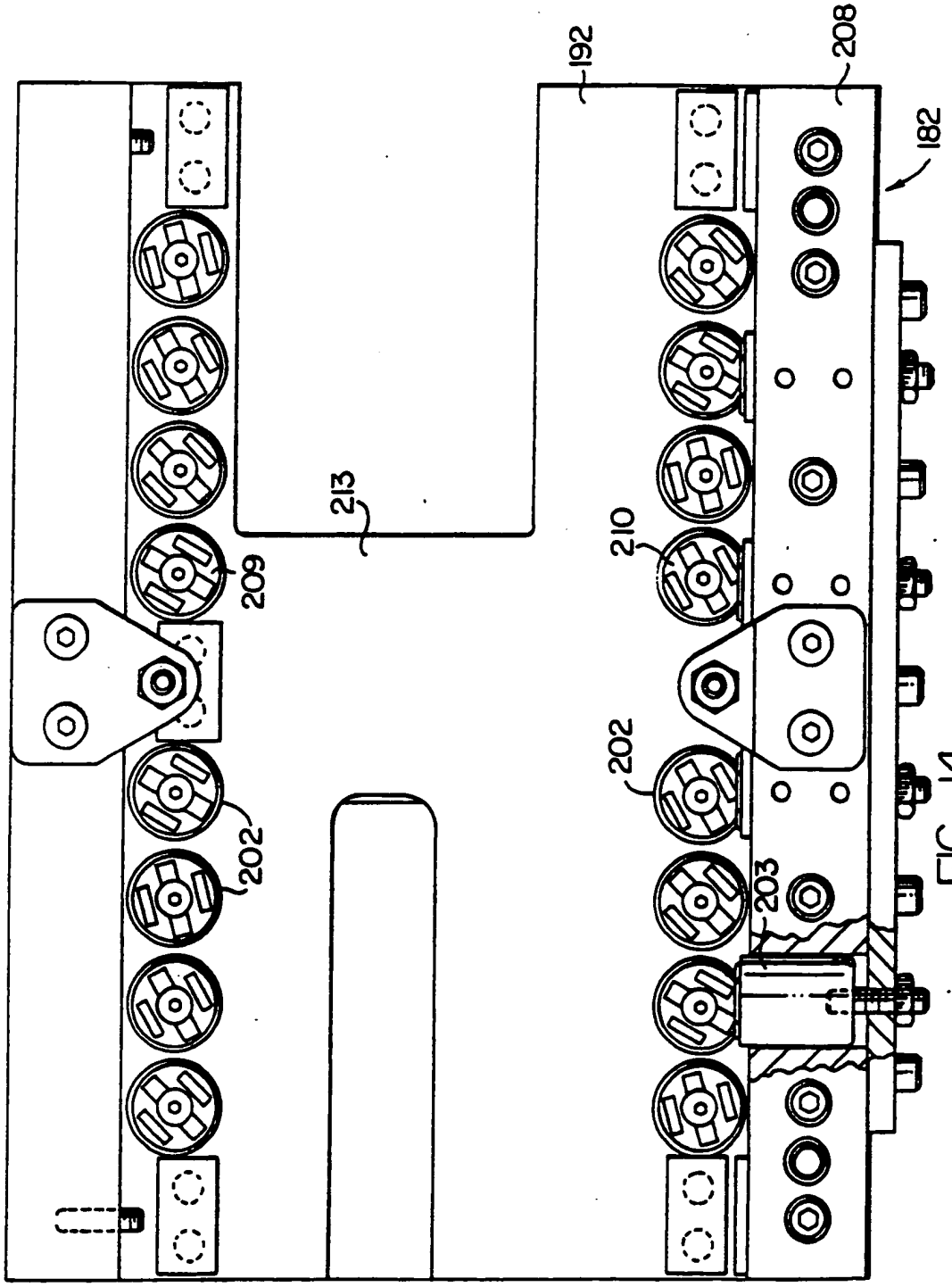

FIG. 14

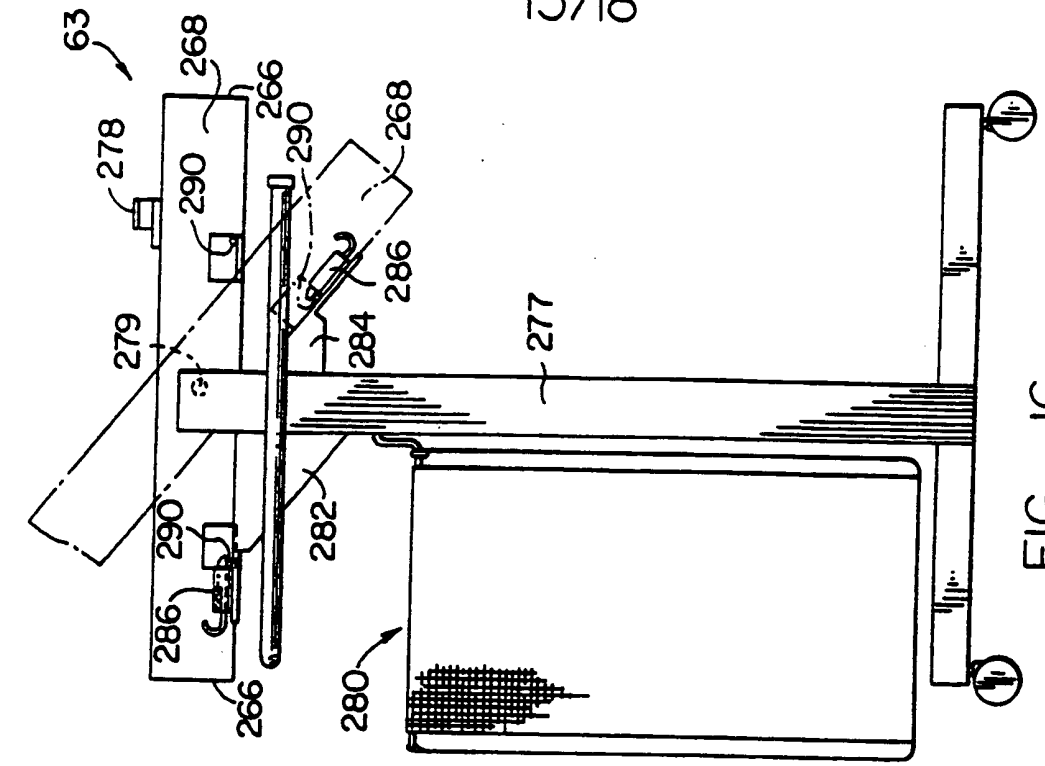

FIG. 16

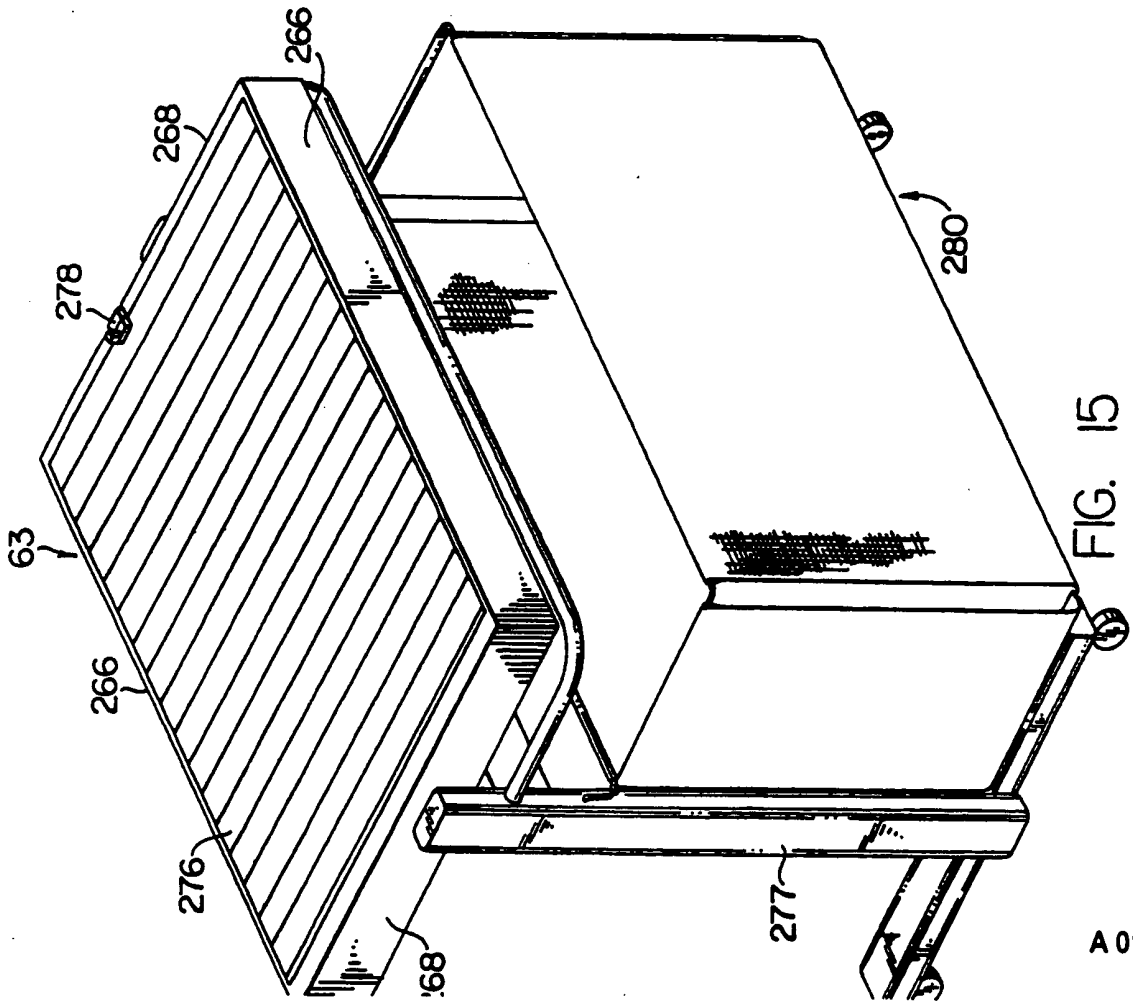

FIG. 15

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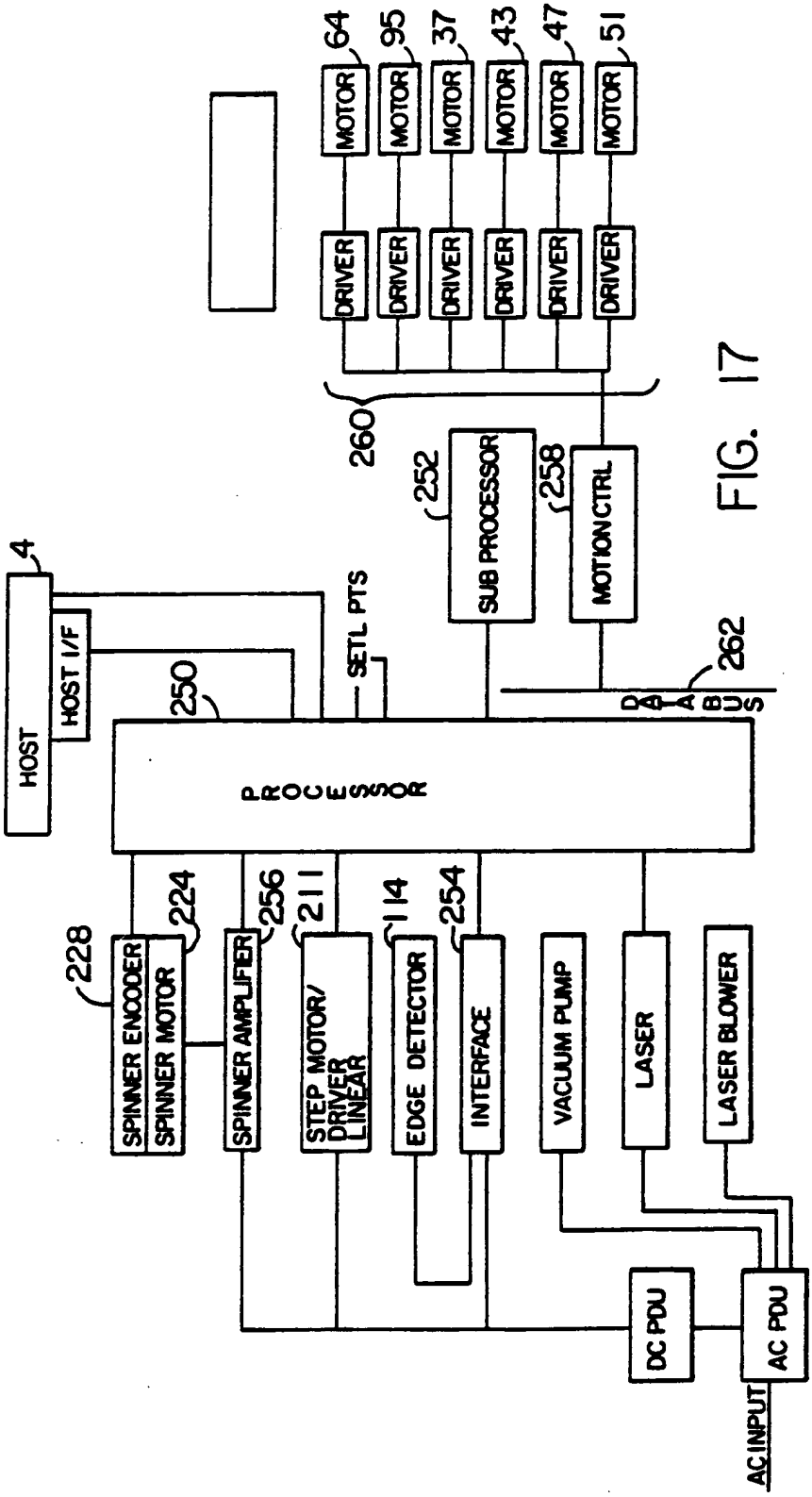

FIG. 17

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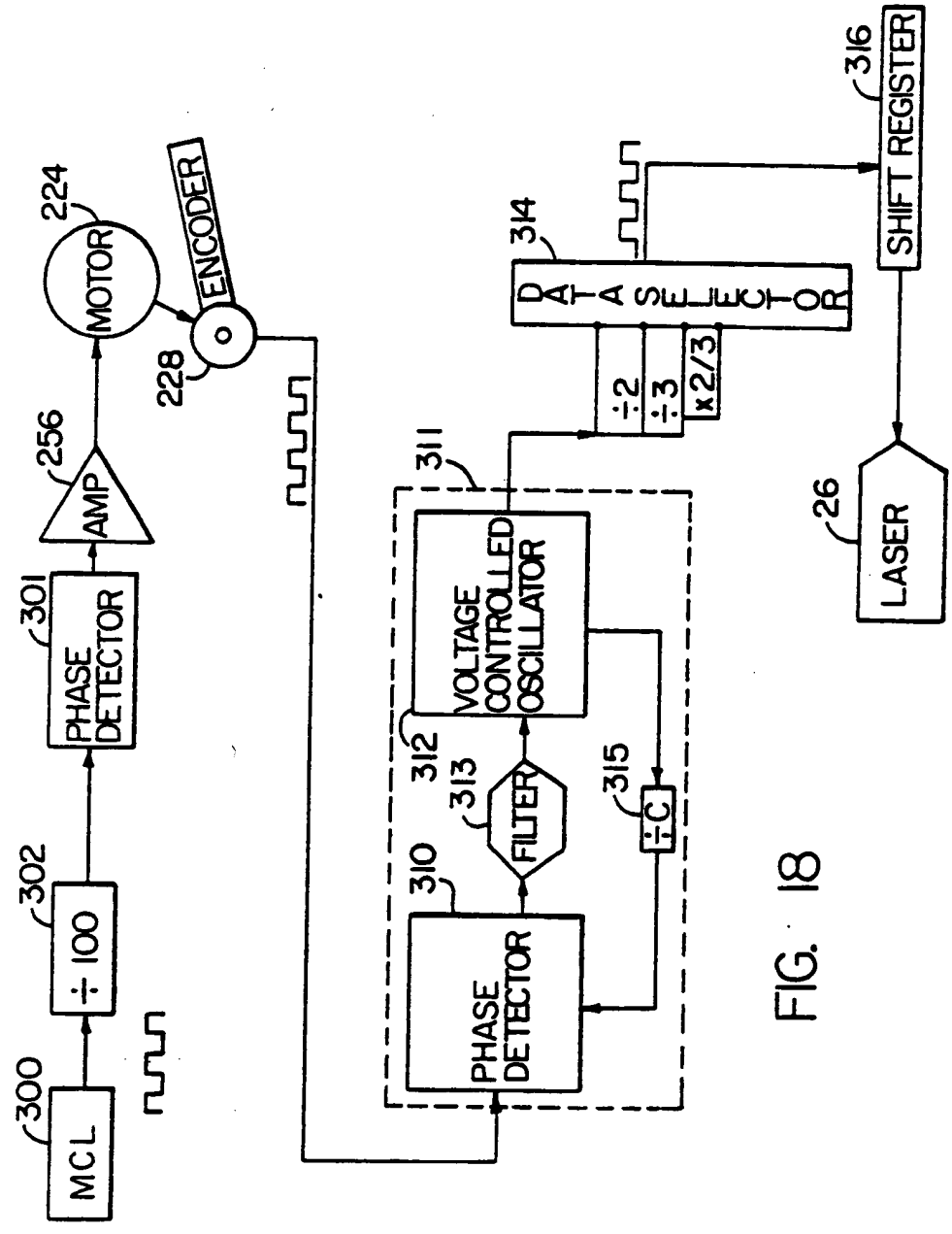
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302
PHASE DETECTOR
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224
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228
PHASE DETECTOR
310
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313
VOLTAGE CONTROLLED OSCILLATOR
312
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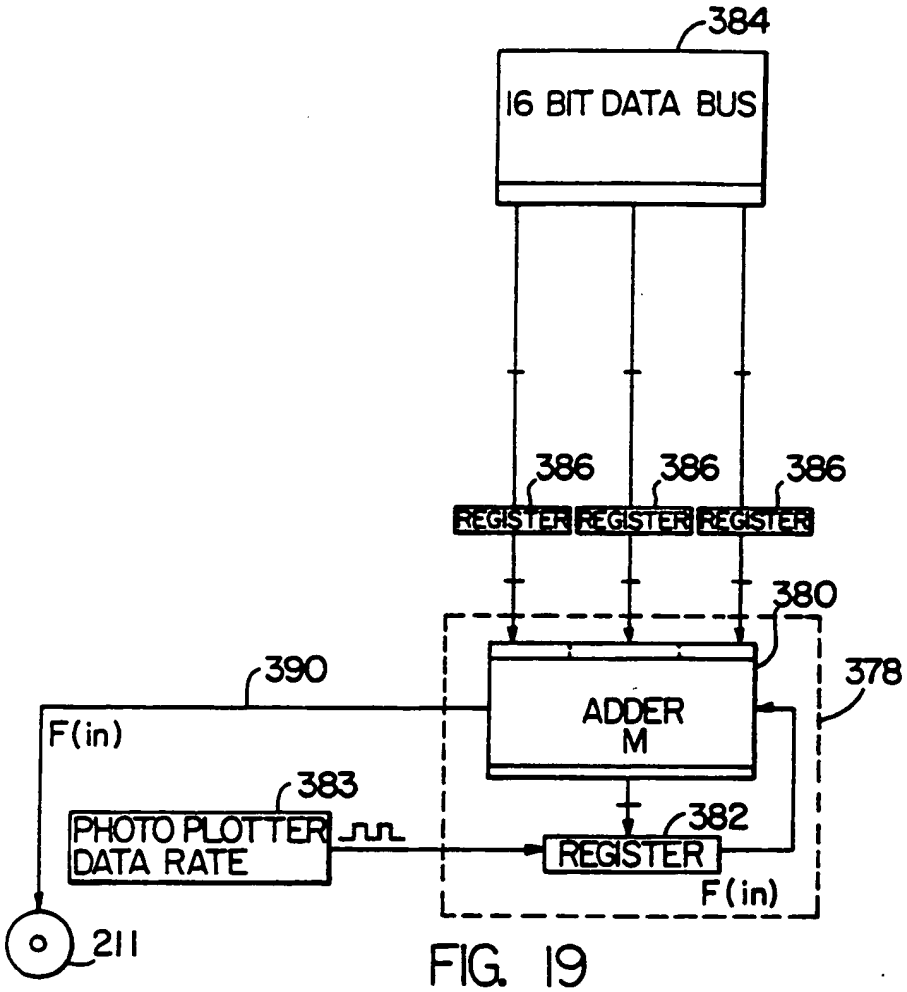
÷C
315
÷2
÷3
x2/3
DATA SELECTOR
314
SHIFT REGISTER
316
LASER
26

FIG. 18


384
16 BIT DATA BUS
386
386
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REGISTER
REGISTER
REGISTER
380
390
378
F(in)
ADDER
M
383
PHOTO PLOTTER
DATA RATE
382
REGISTER
F(in)
211

FIG. 19

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APPARATUS AND METHOD OF POSITIONING PHOTOSENSITIVE MEDIA ON AN EXPOSURE PLATEN

CROSS REFERENCE TO RELATED APPLICATIONS

The present invention relates to co-pending U.S. Patent Application Serial No. 07/839,398, now U.S. Patent No. 5,276,465 in the name of Alan Menard et al. on February 20, 1992, and entitled PLOTTER DRUM AND METHODS OF FABRICATION AND ALIGNMENT THEREFOR, which application being commonly assigned with the present invention, and relates also to co-pending U.S. Application Serial No. 08/071,567, filed on June 1, 1993 in the name of Wolfson et al., and entitled SYSTEM FOR HANDLING CURVED FORM MEDIA AND CASSETTE THEREFOR.

BACKGROUND OF THE INVENTION

This invention relates to a system for positioning a photosensitive media sheet on an exposure platen in registration with a given datum from which datum a scanning operation is conducted on the media sheet and deals more particularly with a media handling system wherein conformable media is capable of being handled from a supply of such media in flat form and configured by the system to take the shape of the drum support surface and further deals with an improvement in laser scanners wherein motion controls of the spinner assembly are directly dependent upon the desired print resolution of the image. Exposing of media by scanning is made more efficient through the use of drum plotters which employ a rapidly spinning projection mirror which directs a light beam from a laser source downwardly onto the photosensitive material which is supported on the drum support surface. Media which is supported on the drum surface must be flexible enough to conform to the arcuate contour of this surface, but made of a strong enough material to be used,

for example, directly in a lithographic printing press. Media consists of a photographically sensitive coating, e.g. emulsion, on a base material of polyester or aluminum. Such media sheets are usually provided in a supply of such sheets layered onto of each other in a flat orientation and contained in a cassette. As such, any handling device which is used to automatically load the media sheets into drum plotters must be capable of handling a somewhat mechanically unstable element between this supply station and the scanning station, and thereafter to any subsequent handling station, such as one wherein the media is developed. Media of the type of which the present invention is concerned has a photosensitive layer or emulsion formed on it which is sensitive to radiant energy in a given wavelength to expose areas of the emulsion where a positive or negative image is to be made. In some instances, the emulsion used is sensitive to room light, and is therefore necessary that loading and scanning operations be done in "dark rooms". Operating in dark rooms is not advantageous from a production standpoint because the workers involved in the handling process must operate in a dimly light room, usually under red light and must always be conscious about the exposure of media to stray room light, such as when a door opens.

Accordingly, it is an object of the invention to provide a media handling system whereby media is taken from a supply of media loaded into the system in a light-tight condition and is thereafter scanned within the light-tight confines of a scanning apparatus; and/or

to provide a media handling device for a plotter wherein the media handled is one which is flexible and the handling device is capable of picking and placing an individual media sheet and conforming it to a given configuration so that it can be supported on the partial cylindric support surface of a drum plotter; and/or

to provide a highly accurate scanning system which is capable of scanning on a media sheet with different pixels densities and light spot diameters in accordance with graphic information inputted as code into the plotter; and/or to provide a scanner in which vibrations otherwise acting on the scanner components are insulated therefrom by structure which negates the effects of such vibrations; and/or to provide a scanner of the aforementioned type wherein scan speed and spinner axis axial movement are related to the maximum resolution capabilities of the system; and/or to provide improvements generally.

SUMMARY OF THE INVENTION

The invention resides in a scanning device, a related material handler and related methods wherein a frame is provided and supports a drum having a means for holding a media sheet on the support surface in registration with at least one reference axis and having a partially cylindric support surface extending along a central axis of a given radius of curvature taken along the central axis. A scanning means is supported by the frame and is juxtaposed relative to the support surface so as to cause a light beam to sweep a path across the support surface. The frame defines a means for receiving a supply of media sheets and maintaining the supply of media sheets in a given orientation with respect to the at least one reference axis. The frame supports a transport means extending between the drum and the supply means for lifting a media sheet from the supply of the media sheets and advancing it onto the support surface where a scanning operation is conducted on it and for removing the media sheet from the support surface after scanning. The supply means maintains the sheets of media in a substantially flat condition and the transport means causes the transported media sheet to conform to a partially cylindric

configuration after lifting it from the supply means for placement onto the correspondingly shaped partially cylindric support surface. The invention also resides in a system and method for creating a pixel clock for clocking image data to a laser in a scanner of the type having a rotating spinner mirror which is responsible for re-directing a light beam directed along its spinner axis onto a partially cylindric drum support surface spaced a given distance from the axis by using the spinner velocity as a reference clock to establish a data rate for the pixel information and for the linear positioning the spinner mirror along an axis.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the plotter and media handler apparatus shown enclosed by its housing.

Fig. 2 is a perspective view of the apparatus shown in Fig. 1 with its housing removed.

Fig. 3 is top plan view of the apparatus shown in Fig. 2.

Fig. 4a is a perspective view of the media transport device.

Fig. 4b is a side elevation view of the transport device of Fig. 4a.

Fig. 5 is a rear elevation view of the main carriage.

Fig. 6 is a side elevation view of the apparatus showing the transport device in its extended position in dotted line.

Fig. 7 is a perspective view showing the discharge roller mechanism of the apparatus.

Figs. 8a and 8b illustrate schematically the automated paper interleaf removal process.

Fig. 9 is a top plan view of the slide tray means. Fig. 10 is a front elevation view of the slide tray means of Fig. 9.

Fig. 11 is a side elevation view of the drum and spinner mirror support system.

Fig. 12 is a partially fragmentary front elevation view of the spinner positioning system.

Fig. 13 is a side elevation view of the spinner assembly carriage shown without the spinner motor or a lead screw drive nut.

Fig. 14 is a top plan view of the spinner assembly carriage with the way removed.

Fig. 15 is a perspective view of a cassette and cassette dolly assembly.

Fig. 16 is a side elevation view of the assembly shown in Fig. 15.

Fig. 17 is a schematic of the general system controller for the apparatus.

Fig. 18 is a schematic showing a pixel clock driver. Fig. 19 is a schematic showing a linear positioning system driver.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Fig. 1, a photoplotting and handling system indicated is shown. The system includes an apparatus indicated generally at 2, a host computer 4 linked to a system controller 6 disposed within the main apparatus responsible for managing image information downloaded from the host computer 4 and for controllably moving articulated parts of the system in accordance with numeric control instructions issued by the system controller. The computer and the system controller are connected by an appropriate control data line, which can be for example, a RS-232 C line. The apparatus as illustrated in Fig. 1 is specifically adapted to be used for light-tight applications. For this purpose, the apparatus is enclosed against light penetration by a housing 5 and light-tight doors 3,3 which when open, permit access by an operator into the interior confines of the apparatus for purposes of loading media and for system maintenance. An opening 1 is also made in one side of the

housing for the purpose of discharging media in a manner which will hereinafter become apparent, and this opening will open to another light-tight environment, such as a processor handler.

The apparatus 2 as illustrated in Fig. 2 is comprised of a media handler 10 and a photoplotter 12 each supported within separate box-like frame structures 14 and 16, respectively, and are connected as modules to create a single unit as illustrated, but are capable of being operated apart from one another, such as in the case where the plotter is desired to be used separately of the handler.

The plotter includes a crescent-shaped drum 18 having a part cylindrical support surface 20 for supporting a media sheet 22 on the drum in a given orientation relative to a point along the indicated central axis Z. It being noted here that the term part cylindric as used to describe the surface 20 means that the surface 20 has a uniform radius of curvature as taken along the Z axis which gives it in cross section an arcuate shape. A plurality of pin holes 23,23 are formed in the surface 20 and are provided for the purpose of drawing the involved media sheet down onto the drum under vacuum pressure. The drum for this purpose includes a manifold system disposed below the surface 20 and communicates between the holes 23 and a pressurized air source (not shown). For a more complete description of the basic construction of the drum 18, reference may be had to the aforementioned co-pending U.S. Patent Application Serial No. 07/839,398, filed in the name of Alan Menard et al. on February 20, 1992, and entitled PLOTTER DRUM AND METHODS OF FABRICATION AND ALIGNMENT THEREFOR.

The photoplotter includes a scanning means 24 comprising a laser radiant energy source 26 secured against movement to the drum 18, a light re-directing mirror 28 which is also secured to the frame 16 so as to re-direct the

intersection of the indicated X and Y coordinate axes. That is, each media sheet that is maintained within the cassette 63 will have its lower left corner in abutment with internal side faces of the 14 cassette extending coincidentally with the indicated X and Y coordinate directions. In this way, the leading edge 110 of the media lies coincidentally with the indicated Y coordinate axis disposed parallel to the Z axis, while the lateral side edge 111 of the media sheet lies coincidentally with the indicated X coordinate axis. Any variation in the width of the sheet along the X coordinate direction is compensated for by moving the secondary carriage 34 to a position over the media such that the second row of suction grippers 90,90 are disposed along the media sheet immediately adjacent its trailing edge. In this way, frontal and rearward areas of the media sheet immediately adjacent will be covered by one or all of the suction grippers 62,62 and 90,90.

Referring now to Fig. 6 it should be seen that a media sheet is drawn off the cassette 63 and is placed onto the support surface 20 of the drum 18 in registration with a given datum taken relative to a spinner axis Z, and that a media handler 10 initially locates the main carriage 32 at the SI location above the cassette 63 with the suction gripper elements each oriented in a depending orientation. The system controller 6 instructs the stepper motors 37, 43, 47 and 51 respectively associated with the R1, R2, R3 and R4 axis drive means to rotate the first and second pickup bars 46 and 55 downwardly so as to cause the respective gripper suction elements 62,62 and 90,90 to engage the topmost sheet of the media 22. Along with this motion, the appropriate solenoid valve is activated to introduce vacuum to both rows of gripper elements. Vacuum pressure to the suction grippers elements is then sensed to determine if a seal has occurred. If none is established, then an error condition is indicated, otherwise the handling process continues. The RI, R2, R3 and R4 axes drive

motors are then reversed so as to cause the media sheet to be raised in the indicated condition shown in Fig. 6 at the S1 station. Thereafter, the drive motor 64 of the main carriage is caused to be energized so as to advance the carriage toward the drum 18. It should be appreciated here that the drum half cylinder support surface opens to the main carriage at an angle of approximately 2S degrees. This feature allows media to be directly linearly advanced to the support surface 20 along a direct line of travel as provided for by the ways 76,76 and 80,80 without having to be lifted over an otherwise upstanding edge. Thus, as the media sheet begins to approach the leading edge LE of the drum it is conformed such that the media assumes the substantially arcuate shape provided for by the drum support surface. This is done by controlled linear movement of the secondary carriage relative to the main carriage in conjunction with the R3 axis control motor being rotated so as to rotate the mounting bracket 50 from an otherwise 3 o'clock position to a generally 6 o'clock orientation. Concurrently with this movement, the R4 axis motor is thereafter rotated in a counter-clockwise condition to pull the trailing edge of the media sheet up to conform it to a generally half cylindric configuration.

Such conforming of the media to the part cylindric shape is of course dependent on material thickness and type. Notwithstanding, the media handler 10 is capable of handling a variety of media having various thickness and dimensions. For example, the apparatus is capable of handling media in the form of photosensitive plates used in a lithographic presses which, in one case, use an aluminum base and having a total thickness of between 8 to 16 mils, or may alternatively be plates having a polymer base having a thickness on the order of 7 to 12 mils. Additionally, the media can consist of a film whose thickness is somewhat less than those listed above, for example, on the order of 4 and 7 mils.

light beam emitted by the laser 26 coincidentally along the central axis Z of the drum 18. The scanning means further includes a spinner assembly 30 which comprises an off-axis parabolic mirror for causing the light beam directed along the Z axis to be turned orthogonally toward the support surface 20 and swept through a given arc across the media sheet in raster format, and focused to the media surface. While not shown in Fig. 2 for purpose of clarity, the spinner assembly 30 is controllably movably mounted along the axis Z through an appropriate way system which is secured to and cantilevered outwardly of the drum 18.

Turning now to the structure of the media handler 10, it should be seen that the handler includes a main carriage 32 adapted for movement along rails secured to the frame 14 for movement in the indicated S direction of travel between a home position SI corresponding to the location of a supply of media, an end of travel position S2 corresponding to the location where onloading and offloading of the media to and from the drum occurs and an intermediate S3 position corresponding to where the media is release to a discharge means for transport away from the apparatus. A secondary carriage 34 is provided and is carried by the main carriage and is moveable relative to it along a way 36 secured against movement to the main carriage and disposed in the S direction of travel.

Each of the main and secondary carriages 32 and 34 include two rotary positioning means for handling the media in coordinated linear and rotational movement such that the media can be lifted from an otherwise flat stack supply of such media and transported to the drum in a part cylindric form. To these ends, a first rotational drive means 44 having a first stepper positioning motor 43 is mounted to the main carriage forwardly outwardly of it on two mounting arms 40,40 for rotating a generally U-shaped yoke member 54 defined

by a transverse bar 56 and two spaced subarms 58,58 extending orthogonally outwardly from the transverse bar 56. The yoke is journalled within the support arms 40,40 and is drivingly connected to the drive motor 43 so as to cause the transverse bar member 56 to be rotated about the RI axis. The mounting arms 40,40 also support a second rotational drive means 38 having a second stepper motor 37 for rotating a pickup bar 46 about a second rotational axis R2 which is spaced outwardly and parallel to the rotational axis RI. Journalled within the subarms 58,58 is a rotating bar 60 which is connected for unitary rotational movement with the pickup bar 46 about the R2 axis. The drive motor 37 associated with the second drive means is mounted to the other of the support arms not holding the drive motor 43 and is drivingly rotatably coupled to the first pickup bar 46 through the intermediary of a notched belt pulley system 61 connected between the output sprocket of the motor 37 and the rotating bar 60. Disposed along the length of the pickup bar 46 are a plurality of suction gripper elements 62,62 which are each individually connected to a vacuum source for the purpose of engaging the top one of a supply of media and lifting it upwards for subsequent handling by the system in a manner that hereinafter will become apparent.

The secondary carriage 34 includes a third rotational drive means 48 having a third stepper motor 47 for rotating a locating bracket 50 about a third rotational axis R3. The locating bracket includes two spaced clamping arms 86,88 rigidly connected to it and clamped to a second rotating bar 84 so that the drive motor 47 of the third drive means 48 controllably rotates the second rotating bar 84 and the two clamping arms 86 and 88 which connect the bracket 50 to the secondary carriage for rotation about the R3 axis. Mounted on the locating bracket 50 is a fourth rotational drive means 52 which includes a fourth stepper motor 51 for controllably rotating a second pickup bar 55 about a fourth

rotational axis R4. The second pickup bar 55 is rotatably journalled in the bracket 50 so as to be controllably rotated about the R4 axis by a gear drive system 53. A plurality of suction gripper elements 90,90 are secured to the second pickup bar 55 and are each separately connected to a vacuum source for controlled pickup of the media. Additionally, the back face of the second pickup bar 55 includes a plurality of pin holes 92,92 which communicate with internal chambers formed within the pickup bar 55, which chambers are connected by separate lines to the vacuum source through dedicated lines separate from those which connect to the suction grippers 90,90.

The main carriage 32 includes a drive motor 64 which is positively drivingly coupled to a drive bar 66 having pinion gears 68,68 non-rotatably connected to it to effect movement between the indicated S1 position immediately over the cassette 63 and the indicated S2 position disposed generally adjacent and above the leading edge LE of the drum 18. Disposed on one lateral side face 70 of the carriage 32, are two pairs 74,74 and 72,72 of vertically spaced guide rollers each having a circumferential groove formed in it to 12 correspondingly mate with a horizontally disposed way 76,76 secured to the frame 14. In a similar manner, two pairs of vertically spaced smooth rollers 78,78 are disposed on the opposite face of the carriage 32 and travel along ways 80,80 fixed to the frame 14 in a parallel spaced relationship to each other and to the ways 76,76. Disposed vertically intermediate the upper and lower ways on each side of the frame 14 is an elongate rack 82,82 which co-acts with the pinion gears 68,68 disposed on opposite sides of the main carriage. Through this co-action, the main carriage through the energization and de-energization of the drive motor 64 is caused to be controllably moved between the Sl, S2 and the S3 positions. The secondary carriage 34 is linearly moveable on the way 36 relative to the main carriage 32 through the

intermediary of a secondary drive means 94. This means includes a second linear drive motor 95, a lead screw 96 drivingly coupled to the output shaft of the motor 95 through the intermediary of a drive belt 98, and a drive nut 100 secured against movement to the carriage 34 so as to transfer the otherwise rotary motion delivered by the drive motor 95 into linear controlled movement in two directions along the indicated S direction of travel. The secondary carriage 34 further includes two pairs of guide rollers 102,102 each having a circumferential groove formed in it for co-acting with correspondingly formed guide edges 104,104 disposed on 13 the way in a parallel orientation along opposite side edges thereof.

The secondary carriage 34 through its mounting bracket 50, as best illustrated in Fig. 4b, also carries a slide band type actuator 106 having a depending hook-like member 108 secured to its sliding output. The hook member 108 is normally maintained at the right side of the bracket for the purpose of moving transversely of the advancement line S to open an otherwise closed cassette cover as will become more readily apparent later when specific reference is made to the details of the cassette.

The frame 14 of the media handler provides a receiving bay 65 which is immediately adjacent the doors 3,3 for receiving a supply cassette 63 in which a supply of media in stack form is contained. The sheets of the stack although uniform in size and in shape can nevertheless vary in size from stack to stack. The media sheets can have a maximum sheet size of 42 inches x 32 inches to a range of 26 inches x 20 inches or less, with the larger dimension being the dimension taken parallel to the axis Z. Notwithstanding, any sheet contained within the cassette 63 is uniformly justified to a given datum. As illustrated in Fig. 3, this datum is indicated by the point O corresponding to the

The leading edge 110 of the media sheet 22 is automatically aligned in a parallel relationship with the Z axis as it is advanced by the handler into a pair of stops 112,112 secured to the surface 20 of the drum 18. The stops act as abutment against which the leading edge 110 of the media sheet is moved against by the rotating action of one or both of the RI, R2 axes drives. The stops 112,112 are positioned so as to create a line which extends parallel to the Z axis to thereby insure correct alignment of the leading edge with it. The stops 112,112 are adapted for sensing proper seating of the leading edge regardless of the type of media being used. In the case of aluminum plate usage, a slight electropotential, on the order of, for example, 15 volts is connected to each of the stops and the circuit is completed through the aluminum base when contact therebetween occurs. In the case where a polymer base plate is used, the stops include a mechanical switch which is activated by the confronting movement of the leading edge against this switch. Once the media is seated against the stops 112,112, vacuum is applied to the drum manifold drawing the media against the surface 20 to fix its registration.

In addition to insuring registration of the media sheet in a parallel relationship with the Z axis, the drum 18 further includes an axial registration indicator means 114 and is included as part of the drum surface 20. This means includes an elongate photosensor fixed within the drum and is exposed outwardly to the scanning path of the spinner 30 by a slit cut through the skin of the support surface 20. The outermost edge of the sensor is coincident with the leftmost edge 116 of the support surface and extends inwardly therefrom a given distance of about l/2 inch. The X axis position of the media on the cassette 63 is laterally inwardly disposed relative to the outer edge 116 of the support surface 20 as shown by the dimension D in Fig. 3. As such, the media handler will advance a given sheet of media onto the support surface such that the lateral

side edge 111 of the media sheet will be disposed generally along the indicated line D. However, variations in the placement of the lateral side edge of the sheet material can be tolerated within certain limits, as related to the length of the optical sensors 114. That is, the lateral side edge of 111 of the media sheet 22 will partially cover the sensor 114 and leave exposed the remaining length between that edge and the edge 116 of the support surface 20. This arrangement provides a means by which a soft datum can be electronically determined by the system controller 6 by causing the scanner 30 to project a beam on the surface 20 starting at the outer edge 116 of the support surface 20 and progressing from that edge along the indicated Z axis. In so doing, the controller 6 interrogates the sensor at given time intervals to establish the point along the Z axis where the scan beam is blocked by the media indicating that an edge has been reached. The establishing of this condition signals the start of the pixel clock for the first raster information used by the laser in the scan. It being noted that before this edge interrogating process occurs, the main carriage is moved to the intermediate S3 position to await completion of the scan, but the imaging may begin immediately after edge detection.

Media sheets are sometimes separated from one another within the cassette 63 by a thin paper interleaf sheet which prevents scratching of the emulsion layer by the plate situated above it. Thus, these paper sheets must be removed automatically by the media handler and discarded prior to advancement of the underlying media sheet onto the drum 18. To these ends, a paper discharge means 120 is provided at the entrance end of the frame 14 and extends generally transversely to the advancement direction S for receiving paper and discarding it in a bin disposed below it. This means includes an upper roller 122 and a lower roller 124, a continuously operating drive motor 126 and a gear drive 128 drivingly connecting the two rollers to one another

such that the two rollers counter rotate relative to one another. The upper roller is journalled within generally vertically oriented slots 132,132 which allow the upper roller to be slightly displaced by the material sheet that is gripped by the otherwise counter rotating roller pair. To aid in the gripping process the rollers are provided with a plurality of resilient annular gripping members 134,134.

The process of removing a paper interleaf as illustrated in Figs. 8a and 8b is first accomplished by rotating the second pickup bar 55 such that its back face is facing downward toward the media cassette so as to dispose the vacuum holes 92 in confrontation with the interleaf paper sheet 140 and then introducing a vacuum source to these openings. This juxtaposition causes the drawing up of the interleaf sheet into engagement with the second pickup bar 55 where upon as illustrated in Fig. 8b, the bar is thereafter rotated about the R4 axis to direct the leading end portion 142 of the paper leaf toward the paper discharge means 120. Simultaneously with this rotation, the second pickup bar 55 is advanced toward the position that it assumes at the S1 position illustrated in Fig. 6 so as to feed the leading edge portion 142 into the counter rotating rollers of discharge means 120 whereupon the vacuum applied to the bar is turned off to allow the paper to be released to the discharge means 120.

A second discharge means 152 is also provided and is mounted to the frame 14 along one side of the apparatus immediately adjacent the opening 1 and coincidentally with the intermediate S3 position for the purpose of discharging an exposed media sheet 22 onto, for example, a conveyor for developing. To aid in this process, an articulated slide means 154 is also provided and is pivotally mounted on the frame 14 for sliding the exposed media sheet toward the discharge means 152 under gravity, and thereafter through the opening 1. The discharge means 152 is identical to the device described with respect to the means 120, except that the length of the counter rotating rollers

are shorter than those used in the first discharge means since they receive the shorter X coordinate direction dimension of the sheet than the longer Y coordinate dimension as in the case with the discharge means 120.

As best illustrated in Figs. 9 and 10, the slide means 154 is comprised of a substantially flat tray 156 having two adjacent sides bordered by upstanding sidewalls 158 and 160. A pivot rod 162 is connected across the bottom of the tray 156 along the diagonal and is supported at its opposite distal ends on the frame 14 within cradles 164 and 166 which allow the rod and the tray to be freely rotatably mounted to the frame for rotation about the illustrated axis R'. The lower cradle 166 is disposed vertically lower than the other cradle 164 such that the axis R' not only extends diagonally across the frame 14 but is also oriented at an angle T relative to a horizontal plane H. In this way, the tray assumes a first inclination wherein the surface of the tray slopes downwardly from its front edge 170 when it is rotated about the axis R' in the indicated direction 172, and assumes a second inclination when rotated in the opposite direction 174 in which orientation the lateral side edge 176 of the tray is located immediately adjacent the rollers of the second discharge means 152. To controllably position the tray in this manner, a double acting actuator 180 is provided and is attached between the leftmost corner of the tray and the frame 14 for this purpose. The actuator is energized between the extended and retracted positions by a solenoid control valve which is in turn controlled by the system controller 6.

To effect removal and subsequent discharge of an exposed media sheet from the drum surface 20, the main carriage and the secondary carriage are advanced to the S2 position from the parked S3 location such that the suction grippers 62 and 90 are positioned immediately adjacent the upper surface of the exposed media which is supported on the drum generally at the

same locations assumed in the delivery process. The vacuum applied to the drum 18 is continued until the suction grippers have been oriented in this manner. At that time, vacuum to the suction grippers 62,62 and 90,90 is applied while simultaneously, the negative pressure to the drum is reversed, such that the media sheet is forced away from the drum support surface 20 by the floating action of the airbed created by the reverse airflow. This reverse action in combination with the applied vacuum to the suction gripper elements causes the exposed media sheet to again be gripped by the handler. A reversal of movements in the RI, R2, R3, and R4 axes is effected to remove the involved media sheet from the drum and again create a generally planar media configuration. The main carriage 32 is then stopped at the S3 position where vacuum to the suction grippers is shut off and the media sheet falls into the tray and is stopped from further downward travel by one or both of the end walls 158 and 160. It is noted that all during this process, the actuator 180 is energized to its extended condition so that the tray assumes its inclination sloping toward the bay 65. After a given interval, the system controller 6 reverse energizes the actuator 180 causing the tray to be tilted toward the discharge means 152 such that the media slides
towards the counter rotating rollers of the means under its own momentum and thereafter is advanced out of the media handler. The main carriage once dropping the media sheet onto the tray, then moves to its home or SI position to repeat the handling process.

Referring now to Figs. 11, 12, 13 and 14, and in particular to the assembly for supporting the spinner assembly 30 for movement along the Z axis, it should be seen that the spinner assembly 30 is effectively suspended in space by a support system 184 which is secured against movement along one side edge of the drum. This support system includes an overhang block 186 on

which is fixedly supported a highly smooth rectangular way 188 extending parallel to the central axis Z, a spinner carriage 182 traveling along the way 188 and a positioning means 190 drivingly interposed between the carriage 182 and the way 188 for controllably positioning the carriage at highly defined increments along the Z axis. The spinner assembly 30 carried by the carriage 182 is comprised of a spinner motor 224, a parabolic mirror 226 having a geometric center coincident with the illustrated Z axis, and an encoder 228 for sensing rotational increments of the motor and translating the same into pulse signals to be used by the system controller.

The spinner carriage 182 as best illustrated in Figs. 13 and 14 comprises a base member 192 and an integrally connected mounting flange 194 depending from the base member
192. The mounting flange 194 has an appropriate opening 196 formed in it for securing the spinner axis motor 224 to the carriage. The base member 192 as illustrated in Fig. 13 has in vertical cross-section a generally U-shaped top portion 198 which is sized and shaped to receive the correspondingly sized and shaped way 188 therein and is defined by a frontal wall portion 208 and a bottom surface 213. The base member 192 is also provided with a plurality of magnetic bearings 202,202 housed within blind bores formed therein. Each of the magnetic bearings 202,202 is secured within its respective bore 204 by an appropriate securement means, such as the threaded screw 206. The plurality of magnetic bearings provide a slide bearing surface 209 and 210 disposed along opposite sides of the bottom surface 213 of the U-shaped portion 198 to draw the base member 192 upwardly into engagement with the metallic way 188. Similarly, the frontal upstanding wall 208 of the U-shaped portion is provided with a plurality of like metallic bearing members 208 which are secured within the wall in the same manner as those discussed with reference to the

bearings 202,202. The combined actions of the frontal wall bearings and the bottom surface bearings causes the carriage to be drawn into contact with the way in the indicated U direction as well as being laterally held in contact with the way in the indicated I direction so as to create a non-interrupted engagement between the carriage 182 and the way on which it travels.

The spinner carriage 182 is slid against the otherwise holding forces created by the plurality of magnetic bearings 202,202 and 208,208 under the controlled linear positioning force of the positioning means 190. This means as best illustrated in Fig. 12 includes a stepper drive motor 211 secured against movement to the way 188, a precision five pitch lead screw 212 extending parallel to the central Z axis and driven in rotation by the drive motor 211 through the intermediary of a 1 to 10 gear reduction box, and a drive nut means 214 interposed between the carriage 182 and the lead screw 212 for converting the otherwise rotational movement delivered by the stepper motor 211 into linear positioning movement. It is a feature of the invention to provide the lead screw with a given length that exceeds the width of the drum surface 20 so as to provide ample residual length for parking the carriage out of interference with the movement of the media handler sub-carriage 34 as it advances a media sheet onto the drum in the manner shown in Fig. 6. In this way, the necessity to return the spinner carriage to a home location before advancement of media is avoided and therefore throughput in the system is increased. The drive nut 214 is secured against movement to the base member 192 of the spinner carriage through the mounting flange and extends concentrically with a through opening 223 formed therein.

The way 188 is secured to the overhang block 186 through the intermediary of connecting screws 218,218 such that the confronting surfaces of the way and the block are pressed together with one another. In order to reduce

the affects of relative thermal expansions between the way and the overhang block as heat is produced during the scanning process, inwardly directed cuts 220,220 are formed in the overhang block and extend generally parallel to the indicated Z axis for the purpose of spacing a portion of the length of the overhang block surface from contacting engagement with the way.

The plotting drum 18 is supported on the frame 12 on four load bearing floating supports 227,227 located at the four corners of the rectangular base footprint of the plotter drum. Each of the floating supports 227,227 is connected to a pressurized air source and are in essence acting as one way actuators which when energized caused the drum to raise from its otherwise lowered hard support condition on the frame 12. In its lowered condition, when the floating supports are not energized, the weight of the drum rests on hard stops which make up part of each support thereby ensuring repeatability in the handling of media onto and off of the drum support surface 20. However, during a plotting operation, pressurized air is introduced to each of the floating supports 227,227 so as to support the drum on a cushion of air. This arrangement aids in the dampening of vibrations otherwise transmitted to the scanning apparatus from other powered sources. Further to these ends, the laser 26 and the light redirecting mirror 28 are both supported by and connected to the drum 18 so as to be subjected to like vibrations and other external effects acting on the drum.

Referring now to Figs. 15 and 16, a cassette and cassette dolly assembly is illustrated in perspective view and shown as it would be rolled in the bay 65 of the media handler in the indicated S direction. The cassette 63 is of a generally rectangular shape having short sides 268,268 and long sides 266,266, the long sides of which extend parallel to the indicated Y coordinate direction and the short sides of which extend parallel to the indicated X coordinate direction when the assembly is rolled into position into the bay 65.

As best illustrated in Fig. 3, the handler frame 14 includes a bumper 270 resiliently mounted on the frame so as to yieldably guide one of the short sides 268,268 into lateral registration with a fixed guide 272 disposed on the opposite side of the frame 14 so as to justify the cassette with reference to the indicated X coordinate direction. Justification of the cassette along the Y coordinate axis is effected by magnetic stop members 274,274 which are fixed to the frame 14 and are so positioned thereon as to engage with the leading side face 266 of the cassette.

The cassette further includes a roll top or tambour cover 276 having a projection 278 which is positioned in line with the depending hook 108 of the slide actuator 106 carried by the secondary carriage 34. The depending hook 108 is located at an end of travel position such that it is capable of engaging the projection 278 as it is moved to its opposite end of travel and therefore open the cover automatically once doors 3,3 are closed to affect opening in the light tight environment of the apparatus.

The dolly also carries a basket 280 which extends rearwardly beyond the rear long side 266 of the cassette so as to catch the paper interleaves which are discharged through the discharged means 120. The dolly also supports the cassette 63 on two upstanding frame members in a substantially flat operating condition as illustrated in Fig. 16. The cassette is pivotally mounted to each of the frame members 277,277 through an appropriate pivot connection 279. A first abutment stop 282 is provided on one side of the frame members 277,277 for the purpose of maintaining the cassette in its normal operating flat condition, but includes a second abutment stop 284 for allowing limited tilting of the cassette about the pivot connections 279 in order to effect easier loading of media. Sliding latch means 286,286 are provided on respective abutment stops 282 and 284 for the purpose of

cooperating with locking pins 290,290 disposed on the cassette to hold the cassette in either of these orientations.

Referring now to Fig. 17 and to the general scheme of the system controller 6, it should be seen that the system includes a main central processing unit 250 which, for example, may be a MOTOROLA 68000 processor, a sub-processor 252 dedicated to controlling the movements of the media handler 10 and an interface 254 dedicated to controlling more specific operations of the photoplotter 12.

The main processor controls the speed of the spinner motor 224 through an appropriate spinner amplifier 256 to ensure a constant spin rate is achieved. The main processor likewise also drives the step motor 211 of the linear drive in accordance with the scheme discussed in Fig. 18 as well as controlling the clocking of pixel information used by the laser to generate a scanned image. The subprocessor 252 controls the handler drive axes motors and the linear drive motors through the intermediary of a bank of drivers 260 which are in turn controlled by a motion control board 258 linked to the sub-controller 252 through an appropriate databus 262. The interface 254 is, among other things, responsible for interrogating the edge detector 114 to determine the soft datum used to begin a plotting operation as discussed above.

It is feature of the invention to vary the spot diameter with the required resolution. For example, the system is capable of scanning in four modes of resolution 3810 dots per inch, 2540 dots per inch, 1270 per inch, and 1905 dots per inch. Accordingly spot diameters are varied with the resolution change as follows:

RESOLUTION	SPOT SIZE
3810	- 8 microns
2540	- 10 microns

1905 - 15 microns

1270 - 20 microns

The second sub-controller 254 is also responsible for the selection of dot sizes in accordance with the resolution requirement set forth as a parameter of the scan. This can be accomplished in two ways, the first is by using a laser to generate a beam of a fixed diameter and thereafter causing the beam to be passed through a selected lens to either reduce or increase a given size diameter. Alternatively, the laser can itself have the capability of creating a beam with variable diameters which can be directly controlled by instructions issued from the sub-controller 254. One such LASAR is produced by a Special Optics Inc. of Little Falls, New Jersey, under Model No. 56-30-2-8X and sold under the trade name Variable Zoom Beam Expander.

Referring now to Figs. 18 and 19, a scheme is shown for creating a frequency by which pixel information is clocked to the LASAR from the host computer 4 and for creating a driving frequency for driving the lead screw drive motor 211 which rate corresponds to the end of one raster line and the beginning of the next successive line. As illustrated in Fig. 18, it should be seen that the pixel clock frequency is

derived from the output of the spinner encoder 228 which is used as the reference clock. The spinner encoder also has an angular positioning detector which is used by the controller 6 as an indicator as to when to begin a scan line for a given raster. However, because the encoder is broken down only into 1000 increments per revolution, a much higher resolution is needed for driving the LASAR pixel information. Thus, the output frequency of the encoder is fed into a phase lock loop 311 to increase the pulse resolution by a multiple of a determined constant C based on the maximum print resolution of the system and

which output frequency is thereafter divided down by a data selector 314 to support the remaining resolutions.

Since the system utilizes the output of the spinner as its reference clock, a means is provided for running the spinner motor 224 precisely at a desired velocity. This means includes providing a main clock 300 having a clock rate of 20 megahertz which is divided by appropriate circuitry at 302 to create a 20 kilohertz rate and passed through a phase detector 301. The phase differential is filtered and is then inputted into the servo-amplifier 256 which drives the motor 224 and controls the spin rate of the spinner motor 224 so as to maintain this rate at a constant angular velocity. As mentioned, the system is capable of scanning with various resolutions and accordingly scans at each resolution are driven at a different frequency as follows:

Resolution (DIP)	Data Rate (MHz)
3810	54.8
2540	36.6
1905	27.40
1270	18.30

The velocity of the spinner motor is selected so as to independently support the highest resolution listed above. That is, the spinner motor 224 rotates at a velocity of 200 revolutions per second so that a frequency of 200 kilohertz is created and inputted to phase lock loop 311 based on 200 (rev/sec) x 1000 (pulses/rev) to support the highest resolution. Notwithstanding, it is a feature of the invention to provide a multiple speed mirror that may generate a faster reference clock for certain applications. That is, the data rate of 54.8 MHz for the 3810 dpi resolution is an upper limit on clock generation and in turn sets the scan rate at 200 scans per second. However, the data rates at 1120 dpi, 1905 dpi and 2540 dpi are substantially lower so that a scan rate of 300 scans per

second or a mirror velocity of the same may be used. This is desirable since at the higher rate, imaging time is decreased.

The phase lock loop 311 is comprised of a phase detector 310 a low pass filter 313 and a voltage controlled oscillator 312 whose output is fed into the data selector

314. The phase detector generates an output signal which is either positive or negative depending upon whether there is a phase lag or phase lead detected. The low pass filter 313 filters out any noise or stray signals from the voltage controlled oscillator 312 which creates the output frequency used as the pixel clock. A digital counter 315 is provided to feed back the output frequency of the oscillator to the phase detector and to divide it down by the constant C. The phase detector locks phase between the input signal which is the input from the rotary encoder 228 and the divided down frequency signal.

The output of the voltage control oscillator is inputted into the data selector or multiplexer 314 whose output frequency ultimately controls the clocking of pixel information through a shift registration 316 used by the LASAR 26. As mentioned, the pixel output rate is variable depending on the resolution sought for a given scan and therefore the data selector is capable of altering the input frequency for each resolution selected with the exception of the 3810 resolution. This is done by dividing the input frequency by (2) in the case where a 1905 resolution is required or by dividing the input frequency by (3) in the case where a 1270 resolution is required and multiplying the input frequency by two-thirds (2/3) in the case where a 2540 resolution is sought.

Referring now to Fig. 19 and to the system for controlling the linear drive stepper motor 211, it should be seen that this system is comprised of a differential data accumulator 378 which includes an adder 380 the output of which is fed to a clocked register 382. The adder is comprised of a 42 bit

accumulator having in essence two inputs and an output 390 which drives the stepper motor 211. The first input is the output of the register 382 which is clocked at 383 the frequency or data rate corresponding to the highest print resolution and remains the clock rate despite whatever different resolution setting is selected. The second input to the accumulator is taken off a databus 384 and fed through three separate registers 386,386,386 which input to the accumulator a constant N. This constant can be changed as a system parameter and is used to vary the frequency which drives the stepper motor 211. As an example of how the accumulator works, the system includes a 16 bit databus on which is placed the constant N which is subsequently loaded into the three separate registers 386,386,386 each being of 16 bit size. Given that a 42 bit accumulator is used, the output 390 of the accumulator will be defined by the following equation:

$$F(out) = \frac{F(in) \times N}{\frac{42}{2}}$$

The constant number N is fed into one input of the adder, and the second input to the adder is the last result in the accumulator. When the register is clocked a new sum is now shifted into the accumulator and that in turn is added against the contact N. The value added to the accumulator is less than 1 and any carry over of this from the accumulator is the result of successive additions to that same value such that the summated value will eventually exceed unity. Thus, the frequency F(out) is equal to the frequency in F(in) multiplied by the constant N so that if N is a number equal to 240, then the frequency out F(out) at 390 would be equal to one-quarter the frequency in F(in). This overflow signal is thus used to drive the leadscrew motor 211.

By the foregoing, a photoplotter and media handler have been described in its preferred embodiment. However, numerous modifications and

substitutions can be had without departing from the spirit of the invention. For example, in order to generate greater resolution in the reference clock established by the spinner motor 224, spinner motor velocity can be increased to effect higher throughput in the machine. Finally, as discussed in the preferred embodiment, the drive motors used in the apparatus have been set forth as being stepper type motors. However, it is well within the purview of the invention to drive the driven parts with servo-controlled motors to effect the same ends.

Accordingly, the invention has been described by way of example rather than limitation.

CLAIMS

1. An apparatus (2) for the positioning of media sheets from a supply of such sheets wherein the sheets are contained in stack form to a support surface having partially cylindric form, said apparatus having further characterized by: a frame (14), a drum (18) supported on said frame and having a partially cylindric support surface (20) extending along a central axis (2) and having a given radius of curvature taken along the central axis, a scanning means (24) supported by said frame and juxtaposed relative to said support surface so as to cause a light beam to sweep a path across the support surface, means (23) for holding a media sheet (22) on said support surface during a scanning operation in registration with at least one reference axis, a means (61) defined by said frame for receiving a supply of media sheets (62) and maintaining said supply of media sheets in a given orientation with respect to said at least one reference axis, transport means (32) extending between said drum and said supply means for lifting a media sheet from said supply of said media sheets and advancing it onto said support surface where a scanning operation is conducted and for removing said media sheet from the support surface after a scanning operation is completed on the involved media sheet, and wherein said supply means maintains said sheets of media in a substantially flat condition and said transport means causes the transported media sheet to conform to a partially cylindric configuration after lifting it from the supply means for placement onto the correspondingly shaped partially cylindric support surface (20).

2. An apparatus as defined in claim 1 further characterized in that said transport means includes a main carriage (32) disposed for movement along a line of action extending generally orthogonally to the central axis of the

drum and having a drive means (68,82) for controllably positioning the main carriage relative thereto, and wherein said main carriage includes a secondary carriage (34) supported by and moveable relative to the main carriage so that the relative movement between the main carriage and the secondary carriage effect the conforming of the media sheet to the partially semi-cylindric shape.

3. An apparatus as defined in claim 2 further characterized by said main carriage including a suction gripper means (62,62) extending generally parallel to the central axis of said drum and said secondary carriage includes a second gripper means (90,90) extending substantially parallel to said central axis of said drum, and wherein each of said first and second gripper means is rotatably controllably mounted respectively to said main carriage and said secondary carriage about respective second and fourth axes (R2,R4).

4. An apparatus as defined in claim 3 further characterized in that said first gripping means is rotatably connected to said main carriage through the intermediary of a two controllable pivot connections (R1,R2) such that said first gripper means is controllably rotated about a first axis and said second axis and said second gripper means is rotatably connected to said secondary carriage through the intermediary of two pivot connections (R3,R4) such that said second gripper means is controllably rotated about a third axis and said fourth axis.

5. An apparatus as defined in claim 4 further characterized in that said secondary carriage includes a slide bar (106) disposed generally parallel to the central axis of said drum, said slide bar includes a depending projection (108) which is engagable with a cover of a cassette to uncover the

cassette when the slide actuator is energized, and the depending projection is normally located at one end of the slide actuator.

6. An apparatus as defined in claim 5 further characterized in that said main carriage drive means includes a rack and pinion drive (68,82) wherein the rack is mounted to the frame along opposing sides thereof and extending orthogonally to the central axis of said drum, and wherein the rack is engaged by pinion drives extending outwardly of the first carriage and engaging within teeth disposed on the rack.

7. An apparatus as defined in claim 6 further characterized in that said secondary carriage and said main carriage are connected to one another through the intermediary of a way (36) which is secured to the main carriage and extends perpendicular to said central axis, and wherein said secondary carriage includes a drive means comprised of a drive nut (100) and lead screw (96) and a plurality of guide rollers engagable on said way, and wherein said lead screw is rotatably connected to the way.

8. An apparatus as defined in claim 7 further characterized in that said drum is supported on four spaced apart floating supports (228) which are air driven between an extended position and a retracted position coinciding respectively to the condition where a scanning operation is being conducted on the media and the condition where a media sheet is being loaded onto the support surface.

9. An apparatus as defined in claim 1 further characterized in that said scanning means includes a rotating light redirecting mirror (28)

mounted for rotation about said drum central axis and for linear movement along a way disposed a said drum parallel to said central axis of said drum, and wherein said rotating light redirecting mirror is rotated coincidentally with said central axis at high speeds by an electric spinner motor.

10. An apparatus as defined in claim 9 further characterized in that said spinner motor is carried by a carriage (182) suspended above said drum such that the rotating light redirecting motor is suspended in space, and wherein said carriage travels along said way and said way is suspended above said drum surface (20) by an overhang block.

11. An apparatus as defined in claim 10 further characterized in that said spinner carriage is linearly driven by a spinner axis positioning means comprising a lead screw (212) and a drive nut (214) assembly wherein the drive nut is secured against movement to the carriage and the lead screw is rotatably supported at opposite ends of said way.

12. An apparatus as defined in claim 11 further characterized in that said lead screw has opposite ends which define its length and is driven by a stepper motor and has a given length which is greater than the length of the support surface (20) as measured along its central axis whereby the spinner carriage can be parked at opposite ends of the lead screw without interfering with the position activity of the first and second transport means.

13. An apparatus as defined in claim 12 further characterized in that said overhang block has inwardly directed cuts (220) formed on its inner face opposing the way so as to limit thermal stresses otherwise existent between

the overhang member and the way occurring as the result of heat generated by the scanning operation.

14. An apparatus as defined in claim 1 further characterized in that said second gripper means includes an elongate bar (54) having a plurality of openings (92,92) formed along one side face, said one bar being capable of rotating about said fourth axis so as to be placed in confrontation with an interleaf sheet of paper (140) contained in the media supply means to draw the interleaf sheet from a supply of such sheets.

15. An apparatus as defined in claim 14 further characterized in that disposed at one end of said frame opposite of the location of the drum is a first discharge means (120) for receiving the paper interleaf drawn away by said gripper means and for discharging the interleaf downwardly to a receptacle (280).

16. An apparatus as defined in claim 15 further characterized in that said first discharge means includes a first drive roller (124) extending across said frame generally parallel to said drum central axis and a second roller (122) disposed above said first roller and being rotatably journalled in a generally vertically extending slot (132), and wherein the first and second rollers are counter rotatably driven by an appropriate gear drive system.

17. An apparatus as defined in claim 1 further characterized in that said first transport means includes a slide bar and is positionable at a station intermediate the supply means and said drum, said intermediate station

including a second discharge means and a slide tray means as part of said supply means operable between two articulated positions.

18. An apparatus as defined in claim 17 further characterized in that said slide tray means includes a substantially planar member (156) pivotally mounted on a rod (162) which is connected to it along the underside thereof and along a diagonal thereof, said rod being received within upper and lower cradles secured to said frame which cause the planar member to have a first inclination directed orthogonally towards the drum central axis and a second orientation directed parallel thereto.

19. An apparatus as defined in claim 18 further characterized in that said second discharge means (152) includes a first drive roller extending across said frame generally parallel to said drum central axis and a second roller disposed above said first roller and being rotatably journalled in a generally vertically extending slot (132), and wherein the first and second rollers are counter rotatingly driven by an appropriate gear drive system.

20. An apparatus as defined in claim 5 further characterized by said supply means includes a cassette having a sides which are placed in registration with first and second coordinate axes one of which axes extending parallel to said drum central axis and the other of said orthogonally disposed axes extending orthogonally thereto.

21. An apparatus as defined in claim 20 further characterized in that said cassette (62) is a light-tight cassette which is covered by a tambour

cover (276) having a upwardly directed projection which is hooked by a depending projection on said slide actuator.

22. An apparatus as defined in claim 21 further characterized in that said cassette is supported by a moveable dolly having two upstanding frame members which pivotally connect the cassette to the dolly (279,279), and wherein said upstanding frame members have two abutment stops (284,284) one of which stops maintains the cassette in a generally horizontal disposition and the other which stops maintain the cassette in an incline disposition.

23. An apparatus as defined in claim 22 further characterized in that a laser (26) is mounted to the drum and a fixed light re-directing mirror is located in line with the output of said laser is also fixed to said drum such that the drum can be independently floated apart from the frame structure to effect dampening of vibrations to the scanner means.

24. A method of creating a pixel clock (Fig. 18) for a scanner of the type having a laser radiant energy source and a rotating spinner mirror which is responsible for redirecting a light beam directed along its spinner axis (2) to a partially cylindric drum support spaced a given distance from the axis, said method being further characterized by: providing a spinner motor (224) and rotating the spinner motor at a constant velocity, providing encoding means (228) at said spinner motor and encoding the angular velocity of said spinner motor to create a first frequency with a given first resolution, dividing (315) the first frequency by a given constant (C) to create a second frequency having a second resolution, selecting the given constant such that said second resolution is substantially higher than said first resolution, and using said second

frequency as a pixel clock to shift image data to a laser radiant energy source (26) to image a media sheet having a photosensitive surface.

25. A method as defined in claim 24 further characterized in that the step of dividing the first frequency by a given constant to create a second frequency having a second resolution further includes matching the phase of the second frequency with that of the first frequency (312).

26. A method as defined in claim 25 further characterized in that said step of matching the first frequency with that of the second frequency includes providing a phase detector (310) and a voltage control isolator (312).

27. A method as defined in claim 26 further characterized by relating the resolution of print quality of the image being scanned to said first frequency and using said second frequency as a data rate and causing the data rate to be altered according to the given resolution selected.

28. A method as defined in claim 27 further characterized altering said data rate to accommodate a given resolution by feeding the data rate into a data selector (314).

29. A method as defined in claim 28 further characterized by providing along with a given resolution for a scan, a given spot size to be projected for that resolution and altering the spot size in accordance with the resolution selected.

30. A method as defined in claim 29 further characterized by providing a linear position drive motor (210) and using the linear drive motor to rotate a lead screw to position the spinner motor along the central axis of said drum, and driving the linear drive motor using a third frequency taken as the overflow of a differential data accumulator (383).

31 Apparatus (2) for the positioning of media sheets from a supply of such sheets.

32. A method of creating a pixel clock for a scanner.

33. Apparatus for the positioning of media sheets from a supply of such sheets substantially as herein described with reference to the drawings.

34. A method of creating a pixel clock for a scanner substantially as herein described with reference to the drawings.

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Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) WPI

Documents considered relevant following a search in respect of Claims :-
1-23

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

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&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	US 4488716 A	(SHECK) see column 13 lines 20-40	1
A	US 4479147 A	(ROSSINI) see Claim 1	1

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